THE IRON AGE

CHESTNUT AND 56TH STREETS, PHILADELPHIA, PA.
Sales Offices
239 WEST 39TH STREET NEW YORK, N. Y.

Contents — October 10, 1935

Owned, Published and Copyrighted by

CHILTON COMPANY
(Incorporated)

Executive and Publication Offices,
Chestnut and 56th Sts., Philadelphia, Pa.

C. A. MUSSELMAN, President
FRITZ J. FRANK, Executive Vice-President
FREDERIC C. STEVENS, Vice-President
JOSEPH S. HILDRETH, "
GEORGE H. GRIFFITHS, "
EVERIT B. TERHUNE, "
ERNEST C. HASTINGS, "
WILLIAM A. BARBER, Treasurer
JOHN BLAIR MOFFETT, Secretary

C. S. BAUR, *General Advertising Manager*
A. H. DIX, *Manager, Reader Service*

Member, Audit Bureau of Circulations
Member, Associated Business Papers

Published every Thursday. Subscription Price: United States and Possessions, Mexico, Cuba, $6.00; Canada, $8.50, including duty; Foreign $12.00 a year. Single copy, 25 cents.

Cable Address, "Ironage, N. Y."

ADVERTISING STAFF

Emerson Findley, 311 Union Bldg., Cleveland
B. L. Herman, 675 Delaware Ave., Buffalo, N. Y.
H. K. Hottenstein, 803 Otis Bldg., Chicago
Peirce Lewis, 7310 Woodward Ave., Detroit
Charles Lundberg, Chilton Bldg., Chestnut & 56th Sts., Philadelphia, Pa.
C. H. Ober, 239 W. 39th St., New York
W. B. Robinson, 423 Park Bldg., Pittsburgh
W. C. Sweetser, 239 West 39th St., New York
D. C. Warren, P. O. Box 81, Hartford, Conn.

MODERN METHOD BRINGS ACCURATE CARBON CONTROL

OBTAINING CARBON CONTROL

Taking a sample of steel used in making Bethlehem Plates, for testing in the carbometer, a galvanometer which establishes definitely the carbon content of the steel. Advanced methods like this have helped to establish Bethlehem's reputation as a maker of plates of unvaryingly high quality.

How Bethlehem Assures Uniformity, Adherence to Analysis, in Steel for Plates

Control of carbon content which results in exceptional uniformity is obtained in melts for Bethlehem Steel Plates by a modern method, used in all Bethlehem plate-making units.

Samples of the molten steel, taken at intervals during the melt, are subjected to analysis by the carbometer, which gives a reading based on magnetic properties of a rapidly cooled specimen. Its accuracy is equal to or greater than the generally used combustion carbon method, which required many times the time necessary for the carbometer. It is far more accurate than the melter's fracture test and quite as rapid. Less than two minutes elapse between taking of the test sample and reading of the accurate result.

This test is an important aid in producing plates of unvaryingly high quality, with the closest possible adherence to the desired analysis.

PROMPT SHIPMENT OF FLANGED HEADS

Bethlehem's flange shop, located near the plate mills and open-hearth furnaces, is equipped to give exceptionally prompt service on flanged or flanged-and-dished heads. As an instance of this service, an order for forty 64-inch-diameter tank heads was shipped within 30 hours after it was received.

Even though the necessary steel plates have to be rolled, discs cut out, and heads flanged and dished, it's not uncommon for Bethlehem to complete and ship orders of substantial size within from 24 to 36 hours after their receipt. That's why so many buyers of flanged and dished heads turn to Bethlehem when heads are needed in a hurry.

PLATE TO RESIST WEAR

This coke-handling operation illustrates one of the many applications of Bethlehem Abrasive-Resisting Plate.

USERS OF PLATE TO RESIST WEAR REPORT SAVINGS

Bethlehem has developed an abrasive-resisting plate which is effecting substantial savings for operators of equipment handling abrasive materials.

Low first cost and long wear are outstanding advantages of this new plate. Known as Bethlehem Abrasive-Resisting Plate, it is a carbon-manganese-silicon combination, costing little more than plate of ordinary steel.

"This is the best plate we have found for resisting wear," reports one user. "In order to handle the same amount of material (gravel) we would have had to replace ordinary steel plates at least five times."

Users of Bethlehem Abrasive-Resisting Plate now include coal and metal mines, gravel and sand plants, brick and other ceramic industries, and operators of cement and road-building equipment. This plate is being used for scraper blades, chutes, loaders, conveyors, mixers, shovels, dump truck bodies, car bottoms, and in many similar applications.

▲▲▲ THE IRON AGE ▲▲▲

OCTOBER 10, 1935

ESTABLISHED 1855 Vol. 136, No. 15

New Lamps for Old

ALADDIN, you remember, possessed a magic lamp. It was an old one and not bright and shiny like the new models, but it possessed powers that the new lamps did not. When he rubbed his magical lamp, a genie appeared and carried out any wish that Aladdin cared to make.

You may also remember how Aladdin's wife was tricked by a magician, who coveted the lamp and who obtained possession of it by disguising himself as a peddler and offering shiny new lamps in exchange for old ones.

We believe strongly in the policy of replacing the old with the new when the new has superior qualities. But we do not believe it would be wise to swap America's magical lamp for an untried new one, however shiny it might be, as some people would have us do.

America's magic lamp has done things for us that Aladdin's could not begin to do. For one thing it has raised our standard of living far above that of any other country in the world. It has made American wages the highest in the world in buying power. It has given American workers the shortest work week of any country. Its efficacy has been apparent even after four years of depression, for what other country could have staked its idle, as we have, to the tune of billions? The average American on relief today lives better and eats more than most of the employed workers in countries that have exchanged their old lamps for new ones.

Our magical lamp is the democratic system of free enterprise and initiative under the profit and loss system. The old New Englanders had a name for it. They called it the spirit of "git up and git."

A certain breed of Americans (it comes hard to call them that) wants us to exchange this spirit of "git up and git" for the spirit of "lay down and take." Lay down your personal liberty and take what the dictator or the Comintern says that you can or shall have. Surrender your privilege of quitting a boss that you do not like and your chance of finding another that will treat you better for the doubtful privilege of having a boss that you cannot quit. Lay down your right to make your own decisions for the questionable reward of "security."

The man who is willing to be regimented as the price of security should join the army. He will be relieved of the problems of choice in return for three square meals a day and a little spending money.

And that return, by the way, is a lot more than the present day reward of the Russian citizens, who traded their old lamp for a new one some 15 years ago.

J. H. VanDeventer

Grain Size and Its Influence on Ste

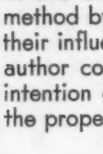
o o o

By B. L. McCARTHY

o o o

RESEARCH work of recent years has thrown new light on the differences in inherent properties of heats of steel and the influence of these properties on the reactions which occur as the result of heat treatment. In this article, the first of a two-article series, the author describes a method by which some of these properties can be determined and shows their influence on the manufacture of wire. For the sake of brevity the author confines his entire discussion to high-carbon wire, not with any intention of minimizing the importance of low-carbon wire, but because the properties he discusses are those brought out by heat treatment and therefore not so noticeable in steels low in carbon.

o o o



THE successful manufacture of steel wire depends to a great extent on the amount of trouble encountered in processing. Steel which does not respond uniformly to the treatments employed will lower the standards of quality and, because of the extra handling often required, prove costly. Uniformity of product, both in individual coils and from day to day, is necessary for the successful operation of the wire drawing department. Much time and study have been given to the chemical analysis and, while the analysis within reasonable limits is important, the part it plays can be determined providing no other variables are encountered.

We are all more or less familiar with the fact that all heats of practically the same analysis do not act alike. This is true in the open-hearth as well as in the wire mill. Because of the need of a common test by which the effects of practices in the open-hearth could be traced on the wire mill, there has been very little helpful exchange between these two departments. A method of grading heats of steel other than by analysis has been developed, the use of which helps to classify the steels being used in the wire mill—this method of grading is known as the McQuaid-Ehn grain size test.

The McQuaid-Ehn grain size test as developed by its originators, Messrs. McQuaid and Ehn,[1] consists of a carburizing treatment in which the samples being tested are heated for 8 hrs. at a temperature of 1700 deg. F. and allowed to cool slowly. The absorption of carbon resulting from this treatment is sufficient to materially increase the carbon content of the outer edge or case, thereby producing a hyper-eutectoid (carbon over 0.90) area containing free cementite (iron carbide).

When steel is at the carburizing temperature it is said to be in "solid solution," metallographically termed austenite. The grains that exist at this temperature are known as austenitic grains. Slow cooling from the carburizing temperature results in the precipitation of free cementite which forms as envelopes around the grains. McQuaid-Ehn grain size is based on a study of the size and number of the austenitic grains, as shown by the cementite markings in the hyper-eutectoid area.

A study of the hypo-eutectoid area in the case of hypo-euctectoid (carbon below 0.90) steels may also be employed to indicate the austenitic grain size. In this case free ferrite precipitates out of solid solution on cooling, forming envelopes around the grains in much the same manner as does the cementite in the hyper-eutectoid area. It is customary, however, to employ the hyper-eutectoid area when McQuaid-Ehn grain size is referred to. The free cementite that surrounds the grains of austentite is termed pro-eutectoid cementite and the free ferrite, pro-eutectoid ferrite to distinguish them from the cementite and the ferrite of the pearlite.

A better conception of the precipitation of ferrite and cementite can be obtained by a study of the iron-carbon diagram shown in Fig. 1. The line *PSK* designated as A1 is the lower critical; below this line we have pearlite, ferrite and pearlite, or cementite and pearlite, depending on the analysis. The point *S* is the eutectoid point and corresponds to 0.90 cabon, the line *GS* designated as A 3 represents the solubility of ferrite at different temperatures and is the upper critical when hypo-eutectoid steels are being treated. The line *SE* designated as Acm represents the solubility of cementite at different temperatures and is the upper critical when hyper-eutectoid steels

*Presented to members of the Wire Association on Wednesday, Oct. 2, at the Hotel Congress, Chicago.

[1] Transactions A.I.M.E., Volume 67, 1932.

Steel Wire Manufacturing

B. L. McCARTHY, honored with the Wire Association Award for the "Most Outstanding Contribution to the Wire Industry During 1935."

are being treated. The line *MO* designated as A 2 is not important in this discussion and therefore need not be considered. The dotted line *GPN*, the exact position of which may vary, indicates the solubility of cementite in ferrite and is important in the development of areas of massive cementite in abnormal steels. When steel is being heated the letter *c* is used after A to indicate heating and the letter *r* when the steel is being cooled to indicate cooling.

When steel is heated to Ac1 the pearlite transforms to austenite; above this line the excess constituent ferrite or cementite, as the case may be, begins to dissolve to form what is termed a solid solution of carbon in gamma iron (austenite). The solution proceeds along the lines *GS* and *SE*. This alters the carbon content of the solid solution until above Ac3 or Accm it will correspond to the carbon content of the steel being treated. On cooling the reverse takes place and as the temperature is lowered to Ar3 or Arcm, depending on the analysis, the free ferrite or free cementite begins to precipitate out of solution, precipitation proceeding along the lines *G'S'*, *S'E'*. This precipitation of the excess constituent again alters the carbon content of the solid solution until at Ar1 it has a carbon content of 0.90, at which point it transforms to pearlite.

The precipitated excess constituent separates to the boundaries of the austenitic grains that existed above Ar3 or Arcm, forming envelopes around the grains. It is in this manner that the structures of the McQuaid-Ehn grain size tests are developed.

The solubility of the cementite in ferrite as indicated by the dotted line *GPN* results in a delayed precipitation of cementite which retards the formation of pearlite by separating out after the Ar1 has been passed.

Abnormal Steels Described

The McQuaid-Ehn grain size test, besides showing the size of the austenite grains, may also be used to indicate what is termed "normality". Steels which on carburizing in this manner show thick irregular envelopes and in which there is a tendency toward a coalescence of the cementite, are termed abnormal, while steels which have thin continuous envelopes are said to be normal. McQuaid and Ehn in their early work associated abnormality with fine grain steels and while it is possible to obtain fine grain steels that are normal, the general tendency is toward abnormality. Abnormality can exist in coarse grain steels as well as in fine grain steels. Rimmed steels are always abnormal. In the case of coarse grain steels abnormality is associated with a high dissolved oxide content. In fine grain steels, however, it is not so easily accounted for. The amount of residual aluminum in solution in the ferrite seems to exert an influence.

Grossman[1] has shown that there is an absorption of oxygen in pack carburizing and that carburizing carried on in the absence of oxygen will not produce abnormal structures, even though the steel is highly oxidized. While this is true, it is nevertheless evident that steels which do not have a great amount of dissolved oxides present prior to carburizing by the McQuaid-Ehn test do not show this condition on carburizing. The structure obtained by the use of the original McQuaid-Ehn test therefore indicates an inherent property as regards normality and may be used as a guide in the selection of steel.

McQuaid-Ehn grain size is expressed in terms of the number of grains per square inch at 100 diameters. A grain size classification using numbers from 1 to 8 has been adopted as standard by the American Society for Testing Materials[2]. Each number covers a range in grain size. Following are the grain size numbers and the ranges they cover: Grain size number 1 specifies up to 1½ grains per sq. in. at 100 diameters; 2, 1½ to 3; 3, 3 to 6; 4, 6 to 12; 5, 12 to 24; 6, 24 to 48; 7, 48 to 96; and grain size number 8 includes 96 grains and over per sq. in. at 100 diameters.

Steels with a McQuaid-Ehn grain size number of 5 and under are said to be coarse grain, while those with a number of 6 and over are said to be fine grain. The term "intermediate grain size" is sometimes used to indicate a range of 4, 5 and 6, and various ranges of numbers are employed to specify

[1] Transactions American Society for Steel Treating, Vol. 16, No. 1, July, 1929.

[2] A.S.T.M. 19-33T.

different grades of steel for special purposes.

Some structures obtained by this test are shown in Figs. 2 and 3. Photo (a) of Fig. 2 shows a coarse grain normal steel as determined by this test. Photo (c), Fig. 2, shows a fine grain normal steel. Note the difference in grain size between these two steels. Photos (a) and (c), Fig. 3, show coarse and fine grain abnormal steels. While the difference in microstructure between the normal and abnormal steels is apparent, this difference is better observed at higher magnifications. In photos (b) and (d), Fig. 2, and photos (b) and (d), Fig. 3, we have these same structures taken at 1000 diameters. Note the thick, irregular network of the abnormal steels as compared with the thin continuous network of the normal steels, also note the tendency toward coalescence in the abnormal steels and the coarse poorly developed pearlite. In the figures discussed above the fine grain steel had been treated with aluminum.

Grain Size Inherent Characteristic

That the grain size, as determined by this test, is an inherent characteristic of the steel has been definitely established. There may be some variations in the grain count on tests from the various parts of a heat and after various hot and cold working operations have been employed but such variations are usually not very great. The analysis for the commonly determined elements does not influence the grain size—coarse and fine grain steels can be obtained over a wide range in analysis. It is very often the case, however, where steel of a certain type will show similar characteristics in the McQuaid-Ehn test, the similarity is due to the practice employed in the melting and deoxidizing of the steel and not to the analysis. An example of this is found in rimmed steels (photos (a) and (b), Fig. 3) which are always coarse grained and abnormal. This is due to the fact that these steels always contain a large amount of dissolved oxides and that no attempt is made to deoxidize them.

This test presents a means by which inherent properties of steel, not revealed by the analysis, can be determined and its many applications have attracted widespread interest. Numerous investigations have been carried on as a result of its use and valuable contributions have been made to add to the knowledge of heat treatment, steel making and deoxidation. Its applications have been made instrumental in the development of higher physical properties, more controlled processes and a better knowledge of ferrous metallurgy in general.

The basic open-hearth metal charge consists of varying amounts of cast or liquid iron and scrap. The iron may vary from cast iron of unknown analysis to high-quality basic iron of uniform analysis. The scrap may be of the heavy melting variety such as rails, croppings from the blooming mill, etc., or of the low-grade type of thin section which can easily be converted to iron oxide before the charge is melted and acts as an absorbent for sulphur gases that may be in the furnace. Limestone, either raw or burnt, is also included in the charge, and usually iron oxide either in the form of roll scale or iron ore. It is important that some iron oxide be present during the melting down to complete the reactions which are necessary for the elimination of impurities.

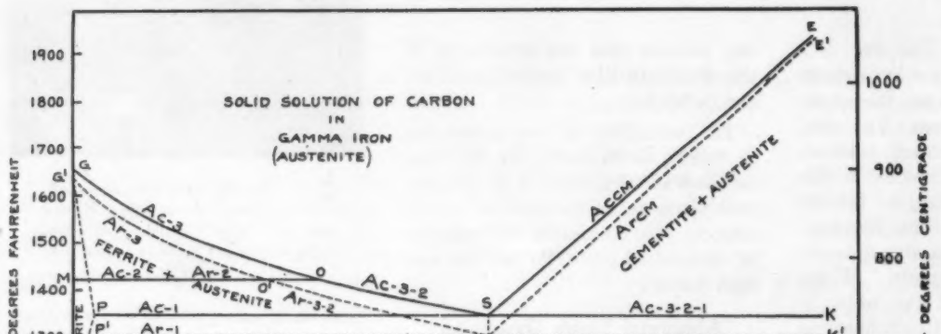


FIG. 1—Fields of the iron-carbon diagram in relation to the critical points on heating and cooling.

After the charge is melted the slag should be put in the proper condition to insure the elimination of excess sulphur and phosphorus. The condition of the slag may also be used as an indication of the amount of iron oxide remaining in the bath and it is advisable to employ some test which will indicate the approximate iron oxide content of the slag. C. H. Herty has published some valuable data on iron oxide control[4] which are very helpful. By a careful study of the charge a furnace condition can be obtained which gives the melter reasonable control of the slag. If, however, the charge is not properly selected the nature of the slag may be such that it is beyond the melter's control. Iron high in silicon requires extra lime and builds up an excessive slag volume. Fine thin scrap, which oxidizes readily, will build up the oxide content of the bath and influence the slag. Extra additions of limestone or silica may be used to put the slag in condition;

[4] Bulletin 68, Mining and Metallurgical Advisory Board, Carnegie Institute of Technology.

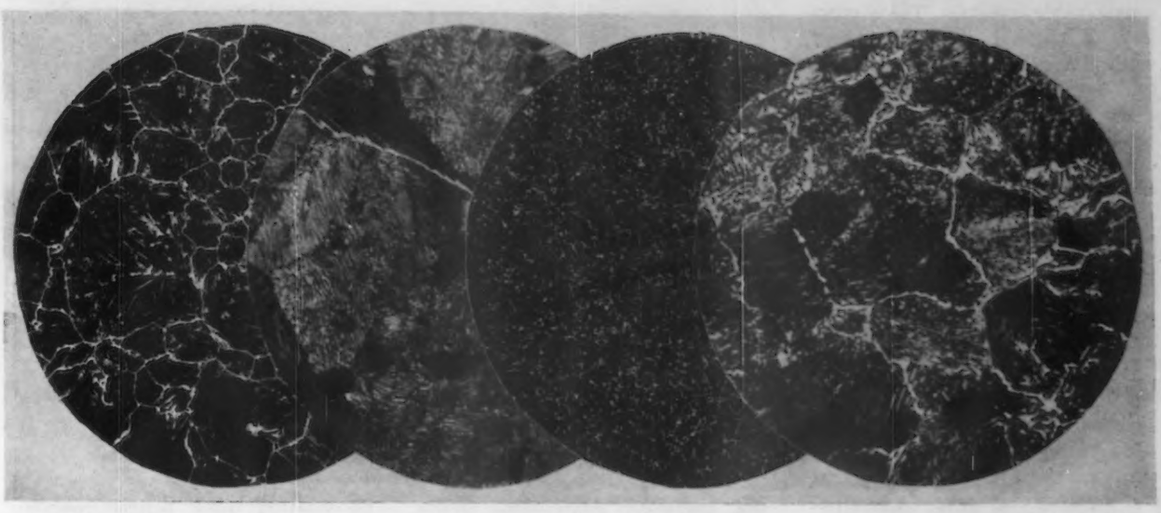


FIG. 2—A representative group of structures obtained by the McQuaid-Ehn test. From left to right respectively (a) coarse grain of normal steel, grain size No. 3 at 100 diameters, (b) the same structure at 1000 diameters, (c) fine grain of normal steel, grain size No. 8 at 100 diameters, and (d) the same structure at 1000 diameters.

however, it is better to employ a uniform charge which will permit the use of the right amount of limestone.

The carbon content at the time of melting and the rate at which it falls should be watched carefully, for, by a study of the carbon behavior some knowledge of the type of charge desired can be obtained which will prove helpful on subsequent heats. The carbon at the time of melting should be high enough to permit sufficient time for shaping up the slag. It is general practice when high-carbon steel is being made to tap the heat while the carbon is falling. Therefore, some control must be exercised over the melt-down carbon and the rate of carbon drop to come within the specification. Running the carbon down and using coal in the ladle to raise it usually results in high oxide content. The presence of carbon in the bath, because of its reducing action, helps to prevent the absorption of oxygen from the furnace atmosphere. While the carbon is relatively high, oxygen absorption is low. However, as the carbon drops, the absorption of oxygen increases.

Charge Made to Suit Furnace

High manganese in the charge helps to reduce oxides and it is desirable, as an indication of low oxide content, to regulate the charge to obtain a high residual manganese.

The condition of the furnace may influence the melting. A slow working furnace may introduce oxides and, when producer gas is being used as a fuel, seriously increase the sulphur. The charge should be made to suit the furnace and, if the furnace is working slowly, sufficient iron should be charged to insure a relatively high carbon content at the time of melting. Also heavy melting scrap should be used.

From the above discussion it is obvious that the making of quality steel is a problem which requires

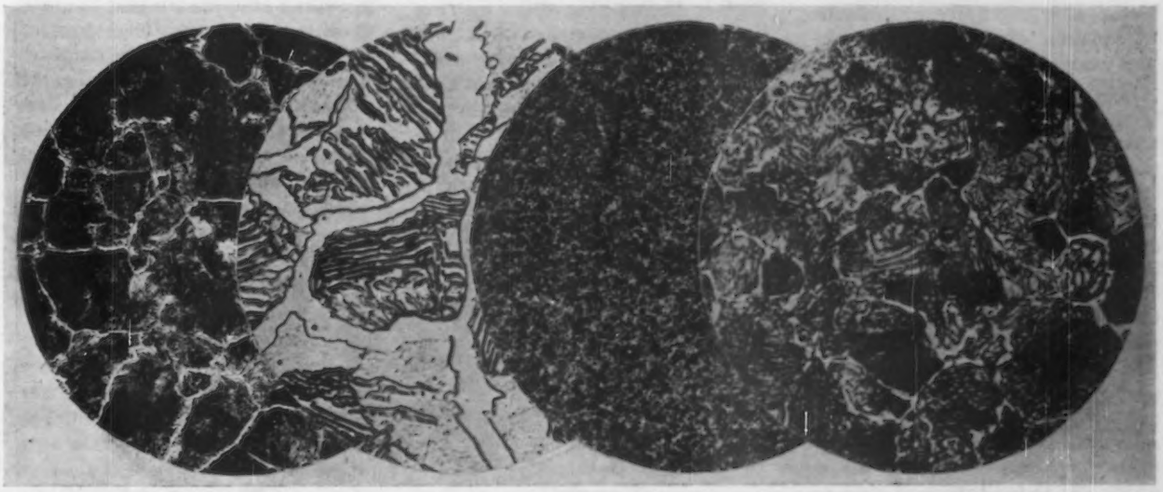


FIG. 3—A representative group of abnormal grain structures. Reading from left to right respectively (a) coarse grain in abnormal steel, grain size No. 4 at 100 diameters, (b) the same grain at 1000 diameters, (c) fine grain of abnormal steel, grain size No. 8 at 100 diameters, and (d) the same grain viewed at 1000 diameters.

considerable attention. The elimination of sulphur and phosphorus, while important, is not the only consideration. The amount of iron oxide dissolved in the steel is of equal importance, as is the control of the other elements. The iron oxide content is important if we are seeking steel which will give a uniform reaction in the patenting operation. As will be shown later, the amount of oxide removed by deoxidation is relative and the fact that the steel lies quiet in the mold does not indicate complete deoxidation.

McQuaid-Ehn grain size tests may be employed to assist the open-hearth in planning the charge and working the heats. A practice which produces a wide variation in grain size in a certain type of steel indicates a poor operation. By using this test as a guide to quality, steel suitable to meet the needs of the wire mill can be produced.

The two views in Fig. 4 show McQuaid-Ehn tests obtained on two different heats and illustrates the variations in structure which may be obtained without proper control of the operation. These heats did not respond to the patenting treatment and caused trouble due to brittle wire. The two views in Fig. 5 show the type of structures obtained on heats that worked satisfactorily and produced high quality wire.

While it is true that this test does not tell the whole story, its use can be very helpful as an indication of steel quality and I can see no reason why wire drawing departments should not insist on its use as a guarantee against the introduction into their processes of steel which may cause trouble.

Deoxidation is an important step in the production of quality steel and is based on the formation, in the molten metal, of insoluble oxides by the addition of elements having a greater affinity for oxygen than iron. The oxide of iron, FeO, is soluble in the molten metal and influences the physical properties. By the addition of manganese, silicon or aluminum, MnO, SiO_2 or Al_2O_3 is formed and slag particles, insoluble in the liquid steel, are produced. The selection of a suitable deoxidizer depends on its affinity for oxygen[5] and the rate at which the product formed rises to the surface. Aluminum, silicon and maganese vary in their affinity for oxygen in the order named; therefore their deoxidation value varies.

[5] Bulletin 38, Mining and Metallurgical Advisory Board.

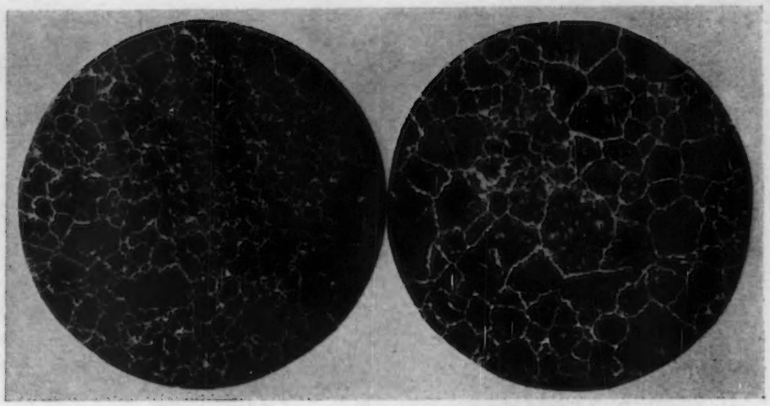


FIG. 4—McQuaid-Ehn test on poorly made heats of steel. On the left is a No. 6 grain size and on the right is a No. 4 grain size. Each taken at 100 diameters.

The rate at which the products of deoxidation rise to the surface depends on the size of the particles. Large particles rise more quickly than small ones. According to Stokes' law, "the velocity of rise is actually proportionate to the square of the particle radius." Products of deoxidation which have a melting point higher than the metal temperature, such as SiO_2 and Al_2O_3 are in solid form and therefore will not coalesce to form large particles. However, if a strongly acid particle encounters a molten basic particle in the steel they will combine to form a slag particle of larger dimension, with a melting point lower than the then molten basic particle. SiO_2 is acid, but FeO and MnO are basic, and SiO_2 will combine with FeO and MnO to form a slag of low melting point. Al_2O_3 particles will not coalesce because of their high melting point and due to the fact that they are nearly neutral in point of acidity or basicity, there is little tendency for them to combine with FeO or MnO, or both, to form a slag of low melting point and flux off. This makes the elimination of Al_2O_3 from the molten steel much slower than the elimination of SiO_2 and MnO and makes the use of aluminum alone as a deoxidizer undesirable. Titanium is also used as a deoxidizer and is helpful in that the product formed (TiO_2) is easily fluxed off.

Aluminum Deoxidation More Complete

Aluminum, because of its greater affinity for oxygen, will carry the deoxidation much nearer completion than silicon or manganese. For many years the use of aluminum has been frowned on in view of the amount of non-metallics left in the steel. However in the manufacture of fine grain steel it has become of real value. The generally accepted theory on the control of McQuaid-Ehn grain size is based on the presence in the metal of numerous finely dispersed particles of a refractory nature. Aluminum, both because of its greater affinity for oxygen and its lack of tendency toward coalescence, has come into general use for this purpose. The usual procedure is to deoxidize the metal, first by the addition of silicon and manganese to the furnace, followed by aluminum in the ladle. Aluminum added in this manner carries the deoxidation further and results in the formation of numerous finely dispersed particles of the Al_2O_3. These particles act as nuclei around which the grains grow and offer obstruction to grain growth. Large particles present in the metal seem to have little influence on the grain size. It is only after the deoxidation has been carried to the point where the fine particles are formed that control becomes apparent.

The manufacture of coarse grain steels presents an entirely different problem, the mechanism of which is not thoroughly understood. That the amount of FeO present, in itself, seems to have little influence is shown by the fact that rimmed steels, which are high in FeO, are nearly always coarse grained. The degree of deoxidation and the rate at which it is progressing seem to have an influence on the grain size when the steel is in the partially deoxidized condition. This is prob-

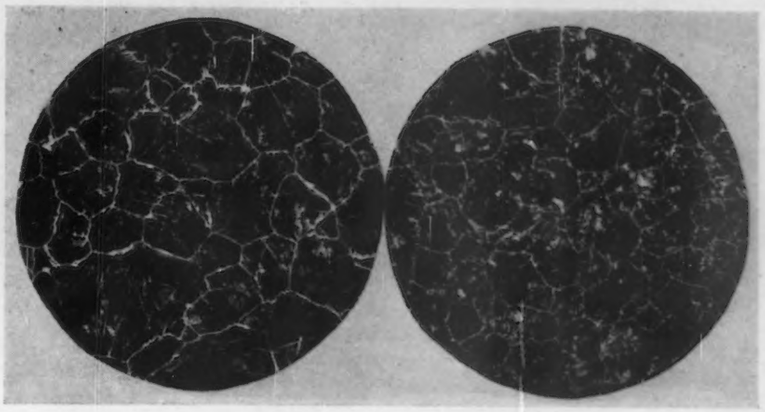


FIG. 5—McQuaid-Ehn test on properly made heats of steel. On the left is grain size No. 3 and on the right is grain size No. 4. Each photo taken at 100 diameters.

ably due to the formation of some fine particles of SiO_2 that have not had time to coalesce to form large particles.

It is therefore important, in the working of the heat, that the amount of oxides in the metal prior to deoxidation be kept as nearly constant as possible in order to obtain the degree of deoxidation desired in the finished steel. The production of steel of uniform grain size from one heat to the next is evidence of uniformity in the deoxidation. By using the McQuaid-Ehn test a knowledge of the deoxidation can be obtained.

As stated above, the formation of fluid slags by the combining of SiO_2 with MnO and FeO is important in the elimination of the products of deoxidation. If silicon alone is added to the furnace the SiO_2 thus formed will slag off by combining with FeO. However this may be incomplete and can be accelerated by the addition of manganese before deoxidation has progressed very far. The use of manganese in the furnace, just prior to tapping, is desirable. While there is some loss, the deoxidizing value of manganese is not sufficient to make this loss too great. At the same time MnO is formed which will combine with SiO_2 and FeO to increase the fluidity of the particle. The use of silicon in the furnace is considered desirable because it affords time for the elimination of deoxidation products.

The term "killed steel" is often too closely associated with deoxidation. The degree of killing is usually indicated by the silicon content of the metal. Steel with 0.05 per cent silicon is said to be semi-killed and steel with 0.20 silicon is said to be killed. Tests made by adding varying amounts of aluminum to the mold to control grain size have shown that the degree of deoxidation can vary considerably in steels of the same silicon content. High-carbon steel is generally more thoroughly deoxidized than low-carbon steel. This is due to a low oxide content in the steel prior to deoxidation. Very often low-carbon steel containing about 0.25 silicon is more highly oxidized than high-carbon steel with a silicon content of 0.10. This proves that deoxidation, as generally employed, depends on the amount of oxides in the metal prior to deoxidation and, under a fixed plan of deoxidation, steel varying in dissolved oxides can be produced if the metal prior to deoxidation varies in oxide content.

A study of the influence of aluminum addition to the steel, on the cutting out of the die in wire drawing, has shown that when properly employed, that is when used after silicon and manganese, no effect was noted. However, 20 oz. of aluminum per ton added to a low-carbon steel produced a considerable amount of Al_2O_3 and some cutting out was noticed when cast iron dies were used. This wire did not cut out when drawn through tungsten carbide dies.

Editor's Note: Next week the author will conclude this review. The influence of hot and cold work on the McQuaid-Ehn grain size will be described and discussed, grain coarsening temperatures will be considered, and actual wire drawing problems will be examined in detail.

Welding Cable Designed For Severe Wear

A NEW type of welding cable designed to meet conditions of extremely severe wear and abrasion has been brought out by the Lincoln Electric Co., Cleveland.

The cable, which is to be marketed by Lincoln in addition to its well-known "Stable-Arc" electrode cable and widely used ground cable, is known as Realwear.

Realwear cable consists of fine-tinned copper wire laid in ropes and stranded. Individual ropes are alternated in succession as regards the direction of the lay to prevent distortion in applications of severe usage.

The conductor of Realwear cable is insulated with an especially developed rubber compound to provide firm adhesion between the cover and rubber insulation.

High-grade cotton woven on a loom and securely joined to the rubber belt by a special process forms the cover. The cover is provided with a finish very resistant to oil, grease, acid, gasoline, moisture and heat. The strength of the new cable is comparable to that of fire hose.

A test of the wearing quality of Realwear cable showed it unusually resistant to abrasive action. The test was made by tying to a delivery truck a length of Realwear cable alongside lengths of two other makes of cable and allowing them to drag over pavement for approximately 20 miles. Observation at the end of the test showed the cover of the Realwear sample hardly worn through, while the other two samples were badly worn, in some places completely through to the copper conductors.

Realwear cable is supplied in sizes 2, 1, 0, 00, 000 and 0000. The number and sizes of strands and outside diameter in inches are as follows:

Sizes	No. of Strands	Sizes Strands, No.	O. D., In.
2	1666	34	0.617
1	2107	34	0.728
0	2646	34	0.775
00	3332	34	0.827
000	4214	34	0.884
0000	5242	34	0.965

Aluminum in Modern

IT was originally believed (and probably true) that aluminum was first used as a corrective for overoxidized heats, and was frowned on as being a means for getting by with poor furnace practice. In view of the present widely used although rather carefully concealed practice of adding aluminum to control hardenability, grain size, etc., and particularly the combination of aluminum addition with greatly improved knowledge and control of the basic open-hearth furnace itself, it was felt that the status of this element had completely changed in recent years. This change in status is, of course, important to user and maker of steel alike, and it is the author's belief that the discussion of this new status of aluminum will be of general interest. Although all the information contained herein is not entirely new, the arrangement has been so careful and the presentation so proper that an entire new light is shed on the relation of aluminum additions to the problems encountered by users of steel.

o o o

MUCH has been written on the subject of variation in the properties of various heats of steel of approximately the same analysis as generally analyzed. Much has been written on the effect of grain size, "normality," etc., on the characteristics of the finished part. Grain-size specification or understandings have become almost universal, especially in the automotive steels. But this consideration has not always been with the best of judgment. Some of our most prominent metallurgists have changed from open scorners of grain-size specifications to become the most ardent advocates. Normalizing and annealing cycles are now predicated on grain-size specifications. Machining results have governed in many cases the grain-size specifications, and so has distortion in quenching, impact requirements and fracture requirements, etc.

In most cases it has been found that the extremely fine grain very abnormal types have definite advantages when combined with sufficiently high carbon, manganese and other alloys to insure satisfactory quenching. While this is being given considerable publicity at the present time, the advantages of the extremely fine-grained type was early recognized by those closely connected with the application of heat-treated alloy steel and the carbon-manganese types.

Grain-size specifications have become so common as to be considered (in this country) a natural requirement where steel-making practice is to a large extent governed by the customer's requirements for a given part, rather than by chemical analysis and soundness tests.

Visitors from abroad who are interested in purchasing steel, and particularly special purpose steel, are amazed at the importance centered in this country on grain-size requirements. They express concern over the fact that European steel producers have not yet gotten into the rather unenviable position of the American steel producer of trying to guarantee that the steel as shipped will make a given part regardless of design of specified analysis. They do not realize the revolution which has taken place behind the scenes in American open-hearth steel practice to permit the steel maker to take this position. And this revolution has been one, not only of open-hearth operation, but also in the viewpoint and policy of the management and sales department as regards obligation to the customer. Few realize the part played by aluminum in this revolution and particularly in its relation to general open-hearth practice and metallurgical control. For aluminum is one of the most difficult of metals to control at steel-melting temperature, and especially in the presence at these temperatures of the easily reducible metallic oxides.

The development in the control of open-hearth operations required to achieve results with aluminum in order to produce steels of definite heat-treating characteristics has been an achievement of no small moment by the steel mill metallurgists. It is sufficient to say at this point that this urgent need of improving open-hearth operations to meet the steel user's insistence on a product of uniform characteristics has resulted in improving the basic open-hearth product to the point that it can be made to a quality equal to any other method of producing commercial tonnage steels.

The effect of grain-size variation on the characteristics of the finished steel has been well covered in the past few years. Epstein and Rawdon, Hardy, Bain, Grossmann, Schane and others have discussed

*Presented Oct. 2 at the Palmer House, Chicago.

Commercial Steels

*Edward De Mille Campbell Memorial Lecture**

By H. W. McQUAID
Republic Steel Corpn., Massillon, Ohio

H. W. McQUAID

the importance of grain-size control, but there has been little published data given as to the part played by aluminum in this work.

Epstein and Rawdon in their classic studies of normal and abnormal steels were the first to publish the importance of aluminum in controlling grain size and normality, and Epstein, Nead and Washburn again at the grain-size symposium in New York last year pointed out the value of aluminum in this regard.

Both these papers were important contributions to the subject of aluminum in steel. Herty and his associates have pointed out several times the difference in characteristics of aluminum and silicon-killed steels. One of the first references to the effect of aluminum deoxidation is found in the paper by Ehn and McQuaid in 1922, in which the fine grain obtained by the aluminum deoxidation is contrasted with the coarse grain of the manganese deoxidation. Photomicrographs showing this difference are shown in Fig. 1.

Most of the investigations to date have been concerned with the general effect of aluminum on grain size and deoxidation results in a general way, and have accepted without much question the oxide dispersion theory as the reason for the aluminum addition other than for straight deoxidation.

History of Aluminum Additions

Before going too directly into the subject of aluminum and its importance to the steel user, it is well to divert our attention for the moment to those small developments from which arose the present interest in the subject of the aluminum addition.

Occasionally in days gone by, in checking case-hardened parts by the routine case depth fracture test, direct quenched pieces would be found that did not show the characteristic coarse crystalline fracture of the plain carbon steel being tested, but would show a fine case with a fine fibrous core fracture. When these appeared they were often analyzed and found to be of the usual analysis with no alloy present. No explanation could be found and these pieces were spoken of as having some peculiar characteristics which made them "perfect" or free from grain growth after long heating at 1700 deg. F. It was noted that case-hardened parts from those heats which showed the so-called perfect fracture were tougher and gave some more trouble in hardening, but when most of the quenching was done in brine, little real trouble was experienced. When the quenching was changed to water, however, and when, during the war, the number of steel sources increased, the trouble with soft work increased greatly and indicated certain sources and certain heats as being particular offenders. When heats were kept separate through the heat-treating department, this was a point easily established.

It is interesting to note that as early as 1919 the men in charge of heat treating were brought into the dark room to see on the ground glass screen the difference between heats which acted "normally" and those which acted "abnormally" as far as the production of satisfactory hardened cases were concerned. The characteristic difference between the coarse normal heats and the fine abnormal heats was obvious to the men directly in charge of the heat treating, and it became the practice to divert the fine-grain abnormal heats to other uses. Since they were the exception, this was no particular hardship. In checking among metal-

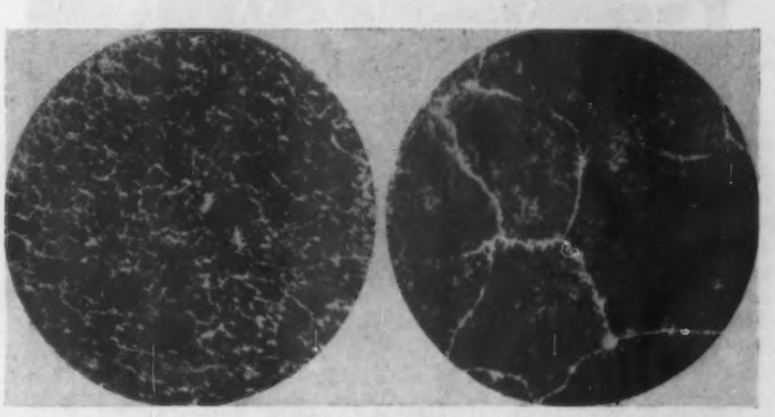


FIG. 1—Fine grain obtained by aluminum deoxidation, as contrasted with the coarse grain of manganese deoxidation. (At Left) Hypereutectoid zone of specimen from ingot deoxidized with aluminum. (At Right) Hypereutectoid zone of specimen deoxidized with ferromanganese. Both views at 200 diameters.

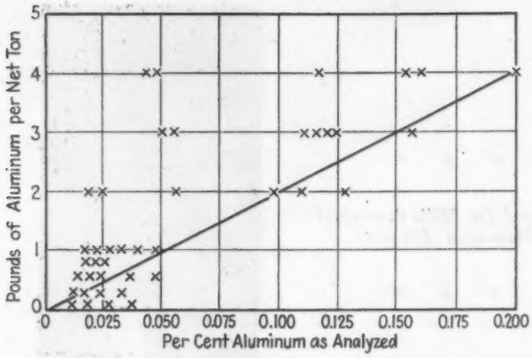


FIG. 2—Aluminum added, as compared with aluminum as analyzed. The straight line indicates theoretical addition.

lurgical acquaintances at that time it was found that this difficulty of soft work in the plain carbon carburizing steel was not new, especially in the making of camshafts and piston pins. One automobile company kept on hand a supply of camshafts which had good hardening characteristics and used these as a check against the steel source when they were in trouble. Thus, whatever the reason, the inability of a given lot of steel to produce good camshafts when the standard camshafts were processing satisfactorily was considered sufficient cause for rejection.

It was soon found that the coarse-grained very normal type, while specifically good for high uniform hardness in case-hardened, plain low-carbon, water-quenched steel, was not suited to alloy gears and many other applications. This of course was due to the deeper hardening characteristics, the increased warpage and the decreased toughness which came with the coarse-grain normal type. It was recognized as far back as 1922 that the finer grained types were better for gears and other alloy grades. Being in a position to compare steel in large quantities from various sources, both in the plain carbon and alloy case-hardening types, it was early recognized by your lecturer that the inherent characteristics of hardenability, toughness, etc., in these steels varied from mill to mill as well as from heat to heat. The difference in ductility, distortion, etc., was easily checked when making hundreds of thousands of duplicate parts of case-hardened carbon steel in a form which permitted easy checking for ductility in the hardened condition.

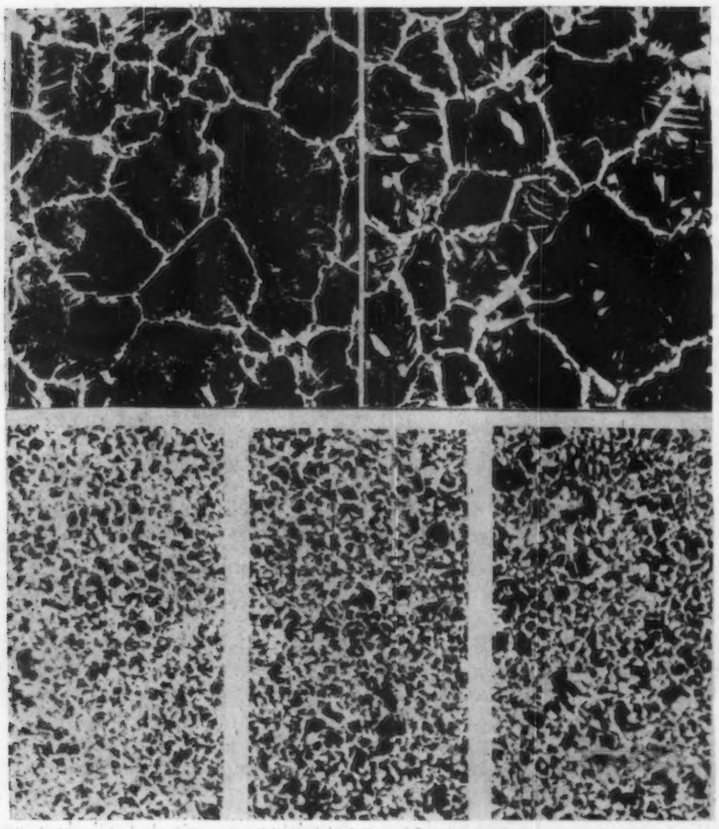


FIG. 3—Microstructures of normalized bars having various aluminum contents. Upper left is heat 523; upper right, heat 123; lower left, heat 222; lower middle, heat, 323; and lower right is heat 422. All photos at 100 diameters.

It is interesting to remember the many valuable discussions of 15 years ago, especially those concerning the use of aluminum. It was plainly evident by 1922 that the properties of case-hardened steel were very much affected by the aluminum additions, and it was agreed then that for some applications the improved toughness made additions of aluminum very desirable. It was interesting at that time to compare the relative toughness of identical parts made from different heats and especially from different sources. The product was such (bearing races) that crushing tests could easily be made to compare the amount of bend before fracture as well as the fracture, and hence many tests could be made from a given heat without difficulty. It was soon established that the so-called coarse-grained normal steel was very brittle as compared to the finer grained types, and the fracture much poorer when single quenched. Since the so-called less abnormal types of plain carbon steel could be apparently successfully hardened in the spray quench, then used, it was decided back in 1922 that the addition of a carefully regulated addition of aluminum to the properly killed heat was desirable to insure the best combination of toughness and hardness. Early in 1923 it was the opinion of one of our leading alloy steel makers that the coarse-grained normal steel was undersirable for gears because of increased distortion and low impacts. Even then it was noted that the coarse-grained type would, with the normalizing equipment then available, give apparently better results in machining.

Aluminum Used in 1922

As noted before, as far back as 1922, the advisability of adding aluminum to heats to improve the "toughness" of the finished part was discussed. In fact, records available show one steel maker in 1919 adding over one pound of

aluminum per ton in the ladle to commercial nickel-chromium steel to improve the "toughness."

Many cases could be cited where carefully regulated combinations of scrap, aluminum additions, etc., were made as far back as 1922. These additions were made to develop better impact values, better fractures, less distortion, etc., and aluminum up to three pounds per ton was used. Bearing steels, axle steel and gear steels were subject to this control and the attention of the mill metallurgist was centered on the alloy grades rather than the carbon grades, although in certain cases, such as in plain high-carbon lock washer stock, etc., aluminum additions were made to improve the ability to distribute stresses and reduce cracking.

While much work was being done on the effect of grain size from 1922 on, and the value of applying the new knowledge was soon recognized, the means for controlling and obtaining the different types were seldom discussed. The introduction of the first grain-size chart in 1924 was evidence that the very intensive study of the data obtained in investigating the effect of deoxidation methods on the characteristics of the finished steel was bearing fruit. It also indicated the value of the carburizing test as a means for indicating the characteristics to be expected in the steel as made.

It is interesting to read the discussion by M. H. Schmid of the original paper by Ehn and McQuaid, in which he indicates the extensive manner in which the carburizing test (McQuaid-Ehn) was applied in 1920-1921 at the plant of the United Alloy Steel Corpn. to alloy steels. This work marked the first study of grain size and normality as we know it today, and soon developed the connection between the grain size and steel characteristics as well as the connection between deoxidation methods and steel characteristics, as witness the first grain-size chart of 1924.

The following is taken from Schmid's discussion of the 1922 paper: "The method outlined . . . offers opportunities of improvement in the product itself and in the selective application of that product. It offers an opportunity for constructive study and experimentation as to the most efficient methods of deoxidation, also for the selective application of heats to meet specific conditions."

In view of what has been done since then, this statement of Mr. Schmid was indeed prophetic. In spite of the fact that from 1922 on an intensive study was being made of grain size, deoxidation and its relation to grain size, and the relation of grain size to results in the finished material, little of anything was published as to the methods employed in so-called grain-size control.

Due to customer and sales pressure, it became increasingly important that a mill producing special steels be fully familiar with the practical problems involved in producing steels having the grain size (and characteristics) demanded by the steel user. From 1922 on, many investigations were made of the factors involved which affected the characteristics of the final product. These investigations covered every phase of steel making from scrap to finished product, and particular emphasis was put on deoxidation control, since it was soon learned that the most important factor in controlling the effect of the aluminum used was in the degree of oxidation and the type of oxides present when the deoxidizers were added. During the development of the practical side of making steel to definite characteristics, much was being done to educate the user on the importance of factors other than chemistry and soundness in the relation of a steel specification to meet a certain part.

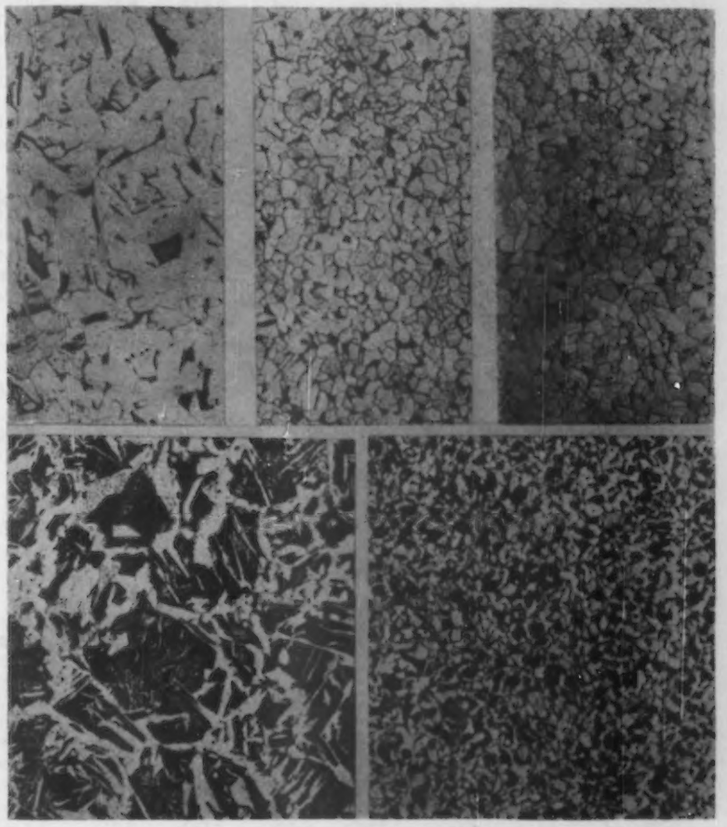


FIG. 4—Variation in structure after normalizing at 1800 deg. F. of steel containing various aluminum contents. Upper left is heat 213; upper middle heat, 412; upper right, heat 313; lower left, heat 221; and lower right is heat 322. All photos at 100 diameters.

In all this work the importance of the part played by aluminum was kept very much in the background. It is only natural that the electric furnace steel maker, who had a more stable and uniform condition of oxidation in his finished steel, should be able to obtain control of his aluminum effect before the open-hearth man could. In fact, for a time, this easier control of uniformity of oxidation and aluminum effects gave the large electric steel maker a definite advantage, and this advantage resulted in a considerable encroach-

TABLE I—CHEMICAL ANALYSIS OF EXPERIMENTAL HEATS

Heat Number	C	Mn	Si	P	S	Al	Al_2O_3	N
				GROUP I				
024	0.40	0.91	0.12	0.012	0.019	0.012	0.019	0.0140
522	0.40	0.95	0.15	0.011	0.030	0.032	0.030	0.0137
122	0.40	0.88	0.18	0.014	0.020	0.026	0.028	0.0142
222	0.37	0.70	0.17	0.013	0.022	0.098	0.020	0.0068
323	0.36	0.74	0.15	0.013	0.028	0.117	0.026	0.0068
422	0.37	0.72	0.17	0.020	0.025	0.204	0.023	0.0074
				GROUP II				
022	0.335	0.45	0.16	0.011	0.029	0.017	0.022	0.0135
521	0.33	0.44	0.19	0.014	0.023	0.013	0.027	0.0097
121	0.325	0.39	0.20	0.019	0.027	0.016	0.026	0.0091
221	0.38	0.44	0.12	0.016	0.023	0.015	0.044	0.0137
322	0.37	0.44	0.15	0.009	0.028	0.055	0.040	0.0132
411	0.26	0.41	0.09	0.009	0.020	0.173	0.029	0.0142
212	0.26	0.49	0.17	0.006	0.022	0.120	0.053	0.0124
421	0.35	0.40	0.15	0.015	0.028	0.129	0.037	0.0115
312	0.26	0.42	0.17	0.020	0.020	0.156	0.034	0.0153
				GROUP III				
015	0.245	1.05	0.14	0.022	0.027	0.011	0.013	0.0111
115	0.245	0.94	0.23	0.011	0.024	0.032	0.022	0.0110
014	0.262	1.01	0.14	0.017	0.021	0.018	0.024	0.0190
513	0.27	1.10	0.19	0.014	0.023	0.024	0.027	0.0196
116	0.26	1.00	0.14	0.013	0.027	0.024	0.016	0.0196
413	0.26	0.95	0.25	0.010	0.025	0.156	0.060	0.0104
				GROUP IV				
118	0.25	1.14	0.18	0.023	0.070	0.024	0.012	0.0185
117	0.24	1.03	0.20	0.020	0.090	0.038	0.025	0.0091
114	0.26	0.89	0.15	0.012	0.125	0.048	0.032	0.0089
				GROUP V				
223	0.49	1.49	0.18	0.012	0.023	0.130	0.035	0.0146
324	0.49	1.44	0.18	0.013	0.026	0.124	0.054	0.0144
423	0.49	1.41	0.25	0.012	0.024	0.046	0.050	0.0121
				GROUP VI				
021	0.39	0.82	0.15	0.023	0.025	0.012	0.022	0.0123
523	0.38	0.85	0.13	0.015	0.028	0.011	0.020	0.0115
123	0.39	0.80	0.15	0.023	0.028	0.015	0.013	0.0111
				GROUP VII				
213	0.12	0.54	0.10	0.012	0.024	0.020	0.044	0.0114
412	0.12	0.51	0.16	0.009	0.025	0.047	0.024	0.0128
313	0.12	0.46	0.26	0.012	0.022	0.110	0.045	0.0119
111	0.16	0.18	0.03	0.006	0.021	0.019	0.035	0.0107
211	0.19	0.22	0.02	0.012	0.024	0.014	0.044	0.0115
321	0.32	0.26	0.03	0.006	0.023	0.120	0.025	0.0190
013	0.21	0.76	0.19	0.022	0.022	0.035	0.006	0.0124
512	0.204	0.64	0.18	0.012	0.025	0.046	0.030	0.0114
113	0.21	0.54	0.17	0.022	0.022	0.017	0.013	0.0120
012	0.20	0.39	0.15	0.010	0.026	0.014	0.018	0.0107
311	0.19	0.33	0.18	0.008	0.028	0.048	0.048	0.0111
023	0.32	0.29	0.17	0.018	0.026	0.017	0.012	0.0059

ment of electric furnace alloy steel in the field of the basic open-hearth.

With the proper customer pressure developed, however, the open-hearth special steel producer was forced to develop the necessary technique to produce steels of the characteristics demanded by the user, with the result that we are just emerging into a new understanding of the possibilities of the basic open-hearth furnace as a producer of high-grade steel.

One of the reasons for keeping the part played by aluminum more or less a secret was the old prejudice against aluminum, due to its use in the past to quiet "wild" heats, etc. There had also been circulated considerable publicity as to the disastrous effect of visible alumina inclusions on soundness, machineability and other requirements for good steel. This publicity was, of course, ascribed to aluminum as a deoxidizer and was due primarily to a lack of knowledge of how a heat of steel should be prepared before an extremely active element such as aluminum is added.

There is little, if any, evidence that the correct addition of a fairly large addition of aluminum to a properly prepared heat will increase to an unsatisfactory extent the amount of visible non-metallics. It cannot be denied that there is some tendency to an increase in the number of inclusions rated as oxides with an increase in aluminum, but the effect on the number of so-called "slag" inclusions is nil.

The increase in the oxide inclusion rating is at the worst small and affected by other variables than aluminum, such as temperature, rate of and extent of deoxidation, etc.

Epstein has stated that aluminum either in the ladle or in the mold does not necessarily result in an increase in inclusions. In plotting inclusion ratings against aluminum additions, it was found that the low aluminum heats killed with manganese and silicon were lowest in oxide-type inclusions, while the low manganese, low silicon heats with aluminum were the highest, as could be expected.

Aluminum Additions Investigated

Much work has been done to determine the balance between the condition of the steel to which the aluminum is added, the timing of the addition in relation to the time of solidification, and the size of the addition. This work, however, has been on a large scale, involving commercial heats, and the results have been more or less empirical.

In the effort to determine more accurately the effect of aluminum additions to plain carbon steel of varying carbon and manganese contents, steel was made in a 300-lb. Moore Electromelt furnace using the same base scrap in every case as well as the same (prepared) slag.

The total metallic charge used was cut from sheet bar, all from the same ingot of a low-carbon rimmed steel heat having an analysis of 0.05 C, 0.05 Mn, 0.04 Si, 0.010 P, 0.030 S, 0.040 N, 0.019 Al, 0.010 Al_2O_3, 0.05 Cu, 0.02 Ni, and 0.02 Cr. The steel was melted in a basic open-hearth furnace under a finishing slag which analyzed 27.5 FeO, 10.2 Fe_2O_3, 10.6 MnO, 9.8 SiO_2, 31.8 CaO, 6.4 MgO, 2.0 P_2O_5, 1.68 Al_2O_3 and 0.13 S. Aluminum addition in ladle was 8 oz. per gross ton, the heat rimmed well and nothing in any way was unusual.

From this standard charge 14 heats were made under as uniform conditions as possible, each heat making three ingots. Each ingot was poured from a separate hand ladle and the aluminum was added to the ladle. The aluminum was wired to a rod and plunged rapidly into the clean surface of the steel in

the ladle after making an opening in the slag. The molds were poured immediately thereafter. Complete analysis of some of these heats are shown in Table I.

The ingots were heated and rolled by hand on a standard 18-in. rolling mill to 1½-in. diameter bars, a record being kept of rolling temperatures, etc. These bars were sampled for "as rolled" test pieces, and then normalized at 1800 deg. F. for 1 hr.

Studies were made of samples from each heat in the as-rolled, normalized and heat-treated condition. These studies included grain growth, grain size, normality, hardenability, impact values, etc., as shown in the following discussion of the results.

It should be admitted at this point that while there was no difficulty encountered in obtaining close chemical analysis checks on the usual elements found in steel, it has been found that the determination of metallic aluminum and alumina offers considerable field for discussion. Several methods were tried in an effort to get consistent results, and the method used did show rather good checks when very carefully followed. It was found that the analyzed aluminum did not check too closely with the aluminum additions, but it was evident that the difference between the analyzed and added aluminum indicated a loss and that the loss increased from the first to last ingot. A graph showing the relation between aluminum added and aluminum analyzed is given in Fig. 2.

The metallic aluminum as analyzed is not assumed to be closely accurate in spite of the rather good checks obtained, but it is considered satisfactory as indicative of the metallic aluminum content and for the purpose of this investigation. Work is being done at this time in conjunction with the Aluminum Company of America to develop more accurate and rapid methods, and it is believed that in a short time a practical, accurate method of determining aluminum will be available.

In considering the results which might be deduced from the data available, it is of value to examine some of the prevailing views which have been advanced as to the causes of the variation in the characteristics of the finished steel.

Bain in his Campbell Memorial Lecture in 1932 gives an exceedingly clear-cut exposition of the connection between effective grain size and the austenite transformation rate which governs the inherent hardenability of a given steel. The fine grain is dependent on, he suggests, the obstruction to grain growth by large numbers of very finely dispensed particles comprised presumably of stable oxides of alumina, vanadia, etc.

He suggests that metallic aluminum as an alloy in steel acts to promote normality and contributes to shallow hardening, its effect as a grain growth inhibitor being due to dispersed insoluble alumina particles.

Epstein and Rawdon, in their very complete report of an extensive investigation of steels of case-hardening grade, report that aluminum added to the mold (as well as vanadium) promotes fine grain, abnormal, structure and affects thereby the inherent hardenability characteristics of the steel to which it is added.

Hardy was one of the first to point out the advantages of grain-size control, and particularly the relation between grain size and toughness in quenched steels. He did not indicate how the control of the grain size was obtained, although he was one of the pioneers in this field and made a thorough study of the effect of aluminum additions to electric furnace steel.

Herty, Larsen, *et al*, indicate manganese content as a primary factor in affecting normality and the importance of aluminum additions. It has been stated that high-manganese steels are of uniformly high hardenability, while the low-manganese steels are of low hardenability, and that manganese is a primary requisite for deep-hardening steels without other alloy.

Scott, on experimental melts, showed that the impact values in steels low in oxygen are very directly affected by the aluminum content.

Many have been the corroborating tests, particularly in practice, to indicate the advantage of controlled hardenability, and it is not necessary to restate at this point

TABLE II—A.S.T.M. GRAIN SIZE AFTER CARBURIZING 8 HR. AT TEMPERATURES SHOWN

Heat Number	C	Mn	Si	Al	Temperature, Deg. F. 1700	1800	1900	
523	0.38	0.85	0.13	0.011	2	2	2	Normal
123	0.39	0.80	0.15	0.015	2	2	2	Normal
222	0.37	0.70	0.17	0.098	6	6	6	Abnormal
323	0.36	0.74	0.15	0.117	6	6	6	Abnormal
422	0.37	0.72	0.17	0.204	7	7	7	Abnormal
213	0.12	0.54	0.10	0.020	2	2	2	Normal
412	0.12	0.51	0.16	0.047	6	3	2	Abnormal to 1900 Deg. F.
313	0.12	0.46	0.26	0.110	7	7	6	Abnormal
221	0.38	0.44	0.12	0.015	2	2	2	Normal
322	0.37	0.44	0.15	0.055	7	6	2	Abnormal to 1900 Deg. F.
121	0.33	0.39	0.20	0.016	2	2	2	Normal
212	0.26	0.49	0.17	0.120	7	7	7	Abnormal
312	0.26	0.42	0.17	0.156	7	7	7	Abnormal
411	0.26	0.41	0.09	0.173	7	7	7	Abnormal

TABLE III—FRACTURE GRAIN SIZE (SHEPHERD STANDARD), SHOWING EFFECT OF ALUMINUM

Heat Number	C	Mn	Si	Al	Temperature, Deg. F. 1400	1500	1600	1700	1800	1900
523	0.38	0.85	0.13	0.011	4¾	5	3¼	2¼	2	2
123	0.39	0.80	0.15	0.015	6	5	5¼	1	1	1
222	0.37	0.70	0.17	0.098	5¾	6¾	..	6	6	2
323	0.36	0.74	0.15	0.117	5¼	6	5¾	5½	5½	2
422	0.37	0.72	0.17	0.204	4¾	7	5¾	5¾	1	1
212	0.26	0.49	0.17	0.120	2¼	3½	4	2	2	1
412	0.12	0.51	0.16	0.047	4	4	5	4	2	1
313	0.12	0.46	0.26	0.110	3¾	4	4	7	6	1
221	0.38	0.44	0.12	0.015	3¼	5½	1¼	1¼	1¼	1
322	0.37	0.44	0.15	0.055	4¾	5¾	5	6	5½	1
121	0.33	0.39	0.20	0.016	3¼	5¼	1½	1½	1	1
212	0.26	0.49	0.17	0.120	3¾	6	5½	4½	4	2
312	0.26	0.42	0.17	0.156	4	6	4½	5½	1	1
411	0.26	0.41	0.09	0.173	4	7	5	5	5	1

the reason for grain-size control. Thus we might sum up the importance of what is termed "grain size" control by stating that this variation in "grain size" is one of the most important factors, if not the most important factor, in determining the reason for the variation in response to quenching, the response to normalizing, and the inherent toughness which exists in commercial heats of steel in spite of close control of chemistry, or at least the usual chemistry. This variation in properties is of tremendous importance to the user of steel, and hence warrants our best efforts to determine the part played by such a factor as aluminum, which is our main reliance today.

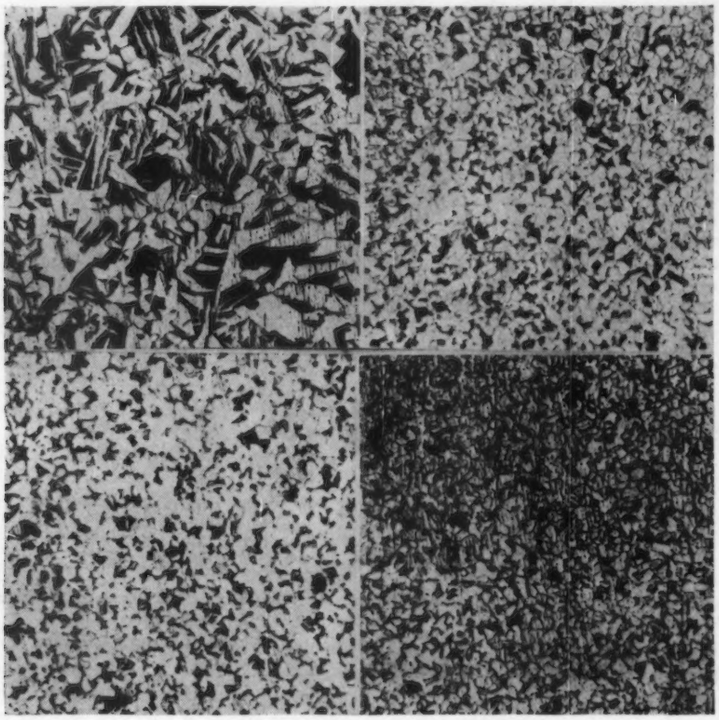


FIG. 5—Structures of steels having various aluminum additions, normalized at 1800 deg. F. Upper left is heat 121; upper right, heat 212; lower left, heat 312; and lower right is heat 411. All photos at 100 diameters.

As an example of the variation which could be expected from heats of approximately the same analysis except for variations in aluminum additions, we can look at the microstructure of normalized bars. Fig. 3 shows heats 523, 123, 222, 323 and 422 (see Table I for analyses), and illustrates the very coarse structure of bars normalized for 1 hr. at 1800 deg. F. and cooled in air when the aluminum content is low. These photos also show the entirely different looking and much finer structure of bars from heats of practically the same analysis but with a fairly high percentage of aluminum when treated the same way. The same difference in structure occurs in the as-rolled bars, providing the finishing temperatures are not high enough to coarsen the structure of the heats to which aluminum has been added, which is quite often the case in smaller sizes of bars. This difference in structure is of importance in cold shearing, tendency to form seams, etc.

Fig. 4 shows microphotos of heats 213, 412, 313, 221 and 322. There is the same variation in structure after normalizing as the heats given before, indicating that the aluminum added has a definite effect on the normalized and as-rolled structure.

Photomicrographs of heats 121, 212, 312 and 411, shown in Fig. 5, demonstrate a similar variation. It is quite evident from a casual study of these normalized structures that the steel user is very definitely interested in the addition of aluminum to the steels which he uses.

If these same heats are carburized according to the standard A.S.T.M. procedure for grain size, using temperatures of 1800 deg. F. and 1900 deg F., as well as 1700 deg. F., it will be found that there is a definite relation of grain size and grain growth to the aluminum additions, indicating that directly or indirectly the aluminum is related to not only the grain size at 1700 deg. F., but the grain growth at higher temperatures, a fact which has been very well shown by Epstein, Herty, etc. These data are shown in Table II.

If the same heats are used to make a fracture test according to the method developed by Shepherd, it is found that there is also a relation between the aluminum addition and the fracture appearance. According to Table III, there is a tendency toward increasingly fine fracture with increasing aluminum, especially at 1700 deg. F. This would indicate a relation between the McQuaid-Ehn grain size and the Shepherd fracture standard, although this agreement, especially at 1900 deg. F., is not quite as close as might be expected, and indicates that the McQuaid-Ehn grain size differs somewhat from the Shepherd test probably due to the fact that the McQuade-Ehn grain size depends upon the formation of excess carbide which tends to inhibit the grain growth at a higher temperature than would be the case in the uncarburized test pieces used in the fracture test.

An effort was made to establish a direct connection between the so-called toughness value in both the normalized and heat-treated condition and the aluminum as analyzed. In most cases it was found that the Izod value was directly related to the hardness which in turn was related to the grain size, a fact which has been well known for years. In the carburized and hardened specimens, as well as the heat-treated specimen, the Izod tests are not sufficiently sensitive to indicate a direct relation with the aluminum as added, except to show that the higher Izod values were obtained in higher aluminum fine-grain heats and varied closely with the hardness obtained.

In an effort to check the toughness of the carburized case, tests were made to determine the Humphrey deflection values on carburized test pieces from the low-carbon heats. This test consists of

a slow bend given to a standard Izod test piece in which it is possible to measure not only the foot pounds required to produce failure, but also the deflection which occurs, due to the application of the load. For graphical relation, see Figs. 6 and 7.

It is interesting to note that the deflection and the foot pounds applied bear a relation to the hardenability of the steel used in making a carburized test piece, and that while this test indicates the ability of the carburized and hardened case to deflect before cracking, the hardenability characteristic of the heat is an important factor in the result. While there was not much variation in the hardness of the Humphrey test piece itself, due to the small size and severe quench, it would seem that the general hardenability characteristic of the heat, which in turn is related to the aluminum addition, has a direct bearing on the toughness of a carburized case, and hence the user of case-hardened material which is of such great importance in the manufacture of gears, etc., is again very much interested in the addition of aluminum to the heats of steel with which he is furnished.

Fig. 8 shows the relation between the hardness at the center of a 1-in. section quenched from 1700 deg. F. in water and the aluminum as analyzed. These heats were selected because of their close carbon, manganese and silicon range, and results indicate a definite relation between the depth of hardness and the aluminum addition. It could, of course, be shown that there is a relation between the grain size and the depth of hardness — a relation which is well known due to the work of Bain and Davenport. It can also be shown that there is a relation between grain size and aluminum addition, so that all that can be stated is that apparently the aluminum bears a definite relation to the grain size in the heats in question, as well as to the hardenability, and that whether the hardenability characteristic is due directly to the fine grain or aluminum addition is difficult to determine with our present knowledge, and might be the subject for a rather interesting discussion and investigation.

Editor's Note:—This paper will be concluded in the following issue of THE IRON AGE.

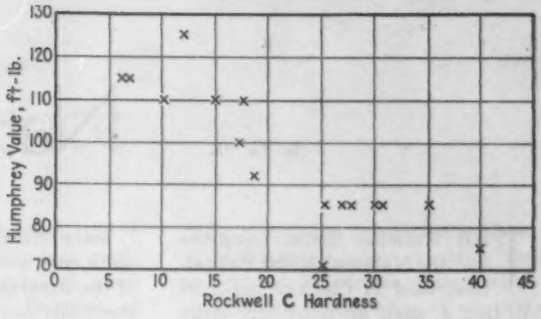


FIG. 6—Showing relation between Humphrey value and depth hardness. Humphrey value from notched Izod test pieces direct quenched after carburizing at 1700 deg. F. for 4 hr. Rockwell C value from depth hardness checks on 1-in. rods quenched in water from 1700 deg. F.

o o o

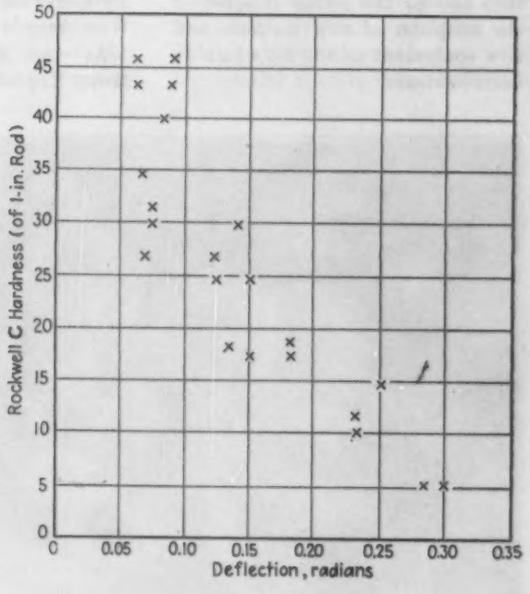


FIG. 7—Showing relation between Humphrey deflection value and depth hardness. Humphrey value from Izod test pieces direct quenched after carburizing at 1700 deg. F. for 4 hr. Rockwell C value from depth hardness checks. 1-in. Rd. 1700 deg. F. in water.

o o o

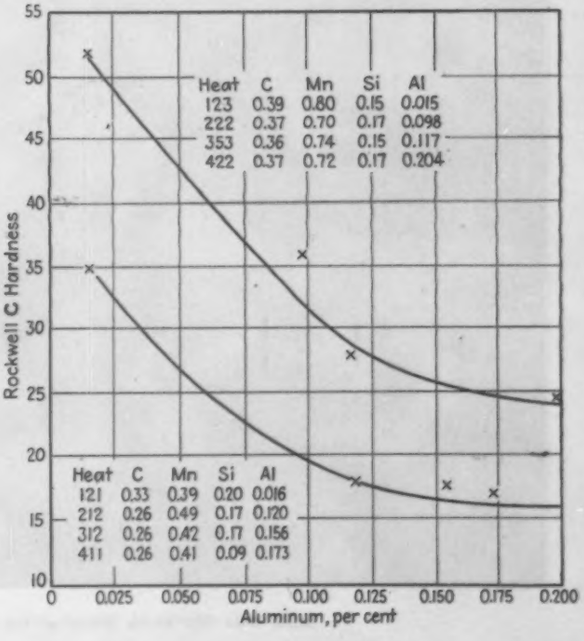


FIG. 8—Showing the relation between hardenability of 1-in. diameter section quenched from 1700 deg. F. in water and aluminum as analyzed.

o o o

... National Metal Congress

THE National Metal Congress and the National Metal Exposition, held in Chicago Sept. 30 to Oct. 4, drew an unusually large attendance, attesting both to indefatigable ingenuity of America in improving the technique of production and to the rising interest in the adoption of new methods and new equipment as the business horizon clears.

More than 75 technical papers were read and discussed in sessions of the American Society for Metals, the American Welding Society, the Institute of Metals Division and the Iron and Steel Division of the American Institute of Mining and Metallurgical Engineers and the Wire Association.

At the Seventeenth National Metal Exposition, held in the International Amphitheatre, registrations rose to 30,000, which was far short of the actual total of persons who passed the gates.

The exhibits covered an area of 170,000 sq. ft. or about 4 acres. The main hall of the amphitheatre, which once a year houses the National Live Stock Show, affords a clear floor space with a high ceiling, which was an advantage in re-

More than 800 broke bread at the banquet of the American Society for Metals. R. S. Archer, president-

Draws Large Attendance ...

moving from the visitors' breathing zone the smoke and fumes generated by the many machines and numerous pieces of equipment demonstrated. On each side of the main hall and on the same floor level were additional large exhibit areas. The total value of equipment and materials shown was estimated at $2,000,000.

As to comparative size the 1935 exposition was the largest in five years. Unusual attention was given by exhibitors not only to the practical and educational features of their exhibits but also to the arrangement and settings which showed a "modern" mode which is unusual in shows of similar character.

It was a common observation that industries are again sending their men to the exhibition in liberal numbers, thereby marking the end of the depression period when one or two observers were all that many companies thought they could afford to send. No attempt was made to estimate the volume of business actually transacted by exhibitors. However, numerous exhibitors reported satisfaction with the results achieved, and optimism

elect presided. William A. Irvin, president, United States Corpn., was the speaker of the evening.

prevailed as to the business outlook for the immediate future.

Each afternoon at 4.30 p. m. Dr. M. A. Grossman, Illinois Steel Co., Chicago, delivered an educational lecture on "Heat Treatment of Steel." The daily attendance was over 300. On each of three evenings over 250 persons assembled to hear the lectures on "Spectrographic Analysis" which were given by Dr. E. J. Martin, research division, General Motors Corpn., Detroit.

Two awards were made by the American Society for Metals. The Henry Marion Howe gold medal, for the best paper published in *Transactions* during the past year, was given to T. D. Yensen, Westinghouse Electric & Mfg. Co., East Pittsburgh, and to N. A. Ziegler, Pittsburgh; and the Albert Sauveur achievement medal, signifying outstanding contribution to metallurgical science, was awarded to Dr. Zay Jeffries, Aluminum Co. of America.

The American Welding Society awarded the Samuel Wylie Miller memorial medal, which signifies meritorious service to the welding industry, to C. A. McCune, director, Magnaflux Corpn., New York.

The annual banquet at which 800 were served was the largest on the records of the National Metal Exposition and Metal Congress. William A. Irvin, president of the United States Steel Corpn., was the principal speaker. Among those at the speakers' table were B. F. Fairless, president, Carnegie-Illinois Steel Corpn.; G. C. Kimball, vice-president, Carnegie-Illinois Steel Corpn.; A. E. McAllister, president, International Harvester Co., and R. H. Cabell, president, Armour & Co.

DR. ZAY JEFFRIES

Awarded the Albert Sauveur medal of American Society for Metals

Irvin Makes Banquet Address

Mr. Irvin paid tribute to the American Society for Metals for the part it has taken and is still taking in advancing the interests of the metal industry.

"Stultifying as have been the effects of the depression in some directions," he said, "it is gratifying to note that in others they have not prevailed over human ingenuity and technical advancement. It almost goes without saying that the productive processes of industry are still primarily dependent upon brains, regardless of how well our plants may be equipped with mechanical devices. Men construct, guide and operate machines; they uncover natural laws, originate ideas, devise methods and make decisions; without their direction and control the application of horsepower and other physical agencies would be futile.

"Metals in production and consumption have always attracted the interest of men, and the metals industry now recuperating from the effects of economic ills is fortunate in the undiminished zeal of its devotees and experts, able and willing to carry their improved products into new fields of service for mankind."

Advances on the technical side of the steel industry in recent years have been marked, he declared, citing the following examples:

1. In many quarters new and improved alloy steels have appeared, including the so-called high-tensile group and certain members of the stainless family.

2. Controlled grain size, dependent upon the careful regulation of many factors involved in making the steel, is now a commercially established feature, affecting numerous products of the industry.

3. The interaction of slag and metal in the open-hearth furnace is better understood, thanks to the large amount of research work which has been done on this subject. Equilibrium, a word heretofore confined to laboratory quarters, is now frequently heard on the charging floor.

4. The all important deoxidation process has been further investigated and rationalized as a necessary complement to the other features mentioned.

5. Non-aging steel has become a factor in meeting certain trade requirements.

6. Improvements in methods of heat treating and physical testing—the results of organized research—have been so numerous and important that only a group of experts, such as those now present, could possibly comprehend their full significance.

7. Implements for the closer and more effective control of processes have been devised both within the industry and by its suppliers, so that in this direction also the happy union between art and science is working for the betterment of all.

"In the adaptation of improved mechanical equipment," Mr. Irvin said, "mention of a relatively few examples will serve to illustrate the trend of developments. Hot strip mills, along with cold reduction mills, probably stand at the head of the list, at least in point of size and attraction of widespread popular interest. Die rolling, electric welding, improved seamless tube mills, and furnaces for heating

N. A. ZIEGLER

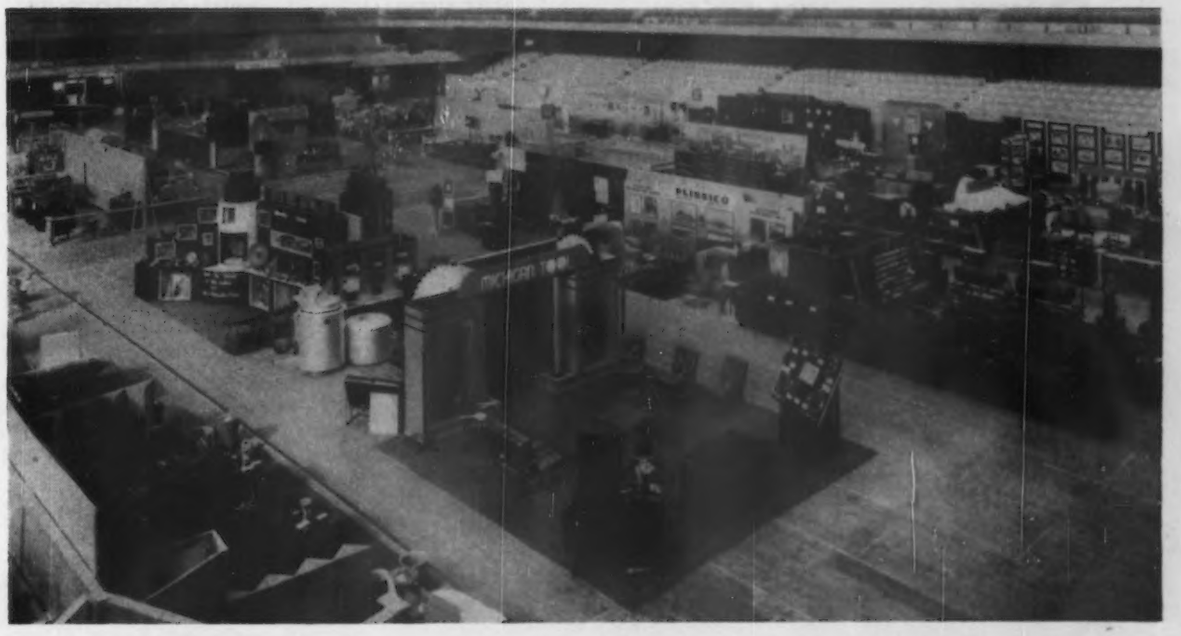
Awarded Henry Marion Howe medal of American Society for Metals jointly with T. D. Yensen

T. D. YENSEN

Awarded Henry Marion Howe medal of American Society for Metals jointly with N. A. Ziegler

steel in controlled atmospheres are performing new services in their respective fields. In all of these examples, which undoubtedly are matched by their counterparts in other lines of the metals industry, we see tokens of continual advancement, and the promise of progressively modern products to meet modern requirements. Evolution and development must continue, if the success of tomorrow is to be greater than the achievement of today."

The American Society for Metals had an extensive and varied technical program. Sessions were held Monday, Tuesday, Wednesday, Thursday and Friday. Morning sessions were at the Palmer House and afternoon sessions at the International Amphitheater. Abstracts of some of the papers follow:



The entire exhibit, of which only the center hall is shown, covered an area of 4 acres. Over 220 booths were required.

Carbon and Strain Aging of Steel

A PAPER on the "Aging of Steel" by E. S. Davenport, research laboratory, United States Steel Corpn., Kearny, N. J., and E. C. Bain, assistant to vice-president, United States Steel Corpn., New York, presented the results of studies of two types of aging. The first type is the moderate increase in hardness which develops gradually in annealed low-carbon steel (0.04 to 0.12 per cent C) at temperatures as low as room temperature following a rapid cooling from temperatures near 1300 deg. F. (700 deg. C.). This phenomenon is most frequently observed in annealed wire and sheet which may have possessed a low-hardness value and high ductility immediately after annealing, but which, after a few weeks of storage, is found to have become harder and to have lost some of its ductility. The aging is explained on the basis of precipitation of iron carbide from ferrite supersaturated with respect to carbon, in a random manner throughout the grains.

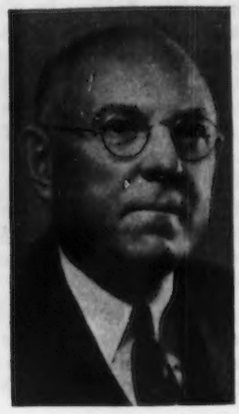
Supporting this conclusion were experiments which disclosed that very low-carbon iron, containing a relatively large amount of oxygen, did not exhibit age hardening, strengthening the belief that carbon is the element involved in the aging and also strongly suggesting that oxygen, under these conditions, does not dissolve and reprecipitate as a fine general dispersion of iron oxide to cause significant hardening. As a final item of evidence with respect to the role of carbon it would be desirable to study an iron-carbon alloy in which oxygen is practically absent and in which the carbon is uniformly distributed. Since it is extremely difficult to produce such an alloy, a 0.05 per cent carbon, soft steel carrying 0.27 per cent of aluminum was employed as a substitute. The solubility of oxygen, even in molten steel, in the presence of a few hundredths per cent of aluminum, is so low as to preclude the evolution of CO during solidification. The solubility of oxygen in the presence of 0.27 per cent aluminum at 1325 deg. F. then must be vanishingly small. Hence, in effect, one is dealing with an oxygen-free material in the case of 0.27 per cent aluminum alloy, so far as the ferrite is concerned. Tests on this indicated strong quench-aging properties, leading to the conclusion that carbon alone, by dissolving and reprecipitating, can cause the phenomena of age hardening after quenching.

Strain aging, the type of aging occurring in steel which has been subjected to some cold deformation, such as cold rolling or wire drawing, was also studied by the authors. The metal is, of course, somewhat hardened at once by the cold work, but instead of acquiring only this usual and familiar increase in hardness, it is observed that most low-carbon steels continue to harden for some time after the cold-working operation. During the ensuing weeks in storage, the steel continues to harden at a diminishing rate and to lose, at the same time, some of its apparent ductility. Following even a relatively small amount of cold work, such as represented by a 5 per cent reduction, for example, almost all low-carbon steels undergo this type of aging. A degree of cold work

R. S. ARCHER

EDGAR C. BAIN

W. H. EISENMAN



WILLIAM P. WOODSIDE

corresponding to 10 or 15 per cent reduction of cross-section appears to result in the most intense changes during aging.

The authors' studies led them to the conclusion that, in strain aging, ferrite seemingly supersaturated with oxygen rejects an iron-oxygen compound in the slip bands of cold-worked grains and is thereby hardened.

Carbon aging can be prevented by "pre-aging" or "equilibrating." In the authors' words, "whenever it is desired to forestall slow, gradual changes toward equilibrium in alloys which by virtue of previous heatings are out of equilibrium at the service temperature, they may be more or less stabilized by heating at a temperature slightly above the service temperature."

Pre-aging for strain aging is accomplished by working the metal cold and then heating to some temperature of rapid precipitation and coalescence. This treatment succeeds in putting away some portion of the dissolved oxygen in the form of a harmless particle distribution. The trouble, however, with this treatment is that the action is not complete; another succeeding cold-working operation appears to recondition new metal for precipitation and there is unfortunately still some oxygen to be precipitated. Accordingly, the operation of cold working and reheating may have to be repeated several times to be effective. It is safe to predict, however, that sheet or strip, which has been produced by means of a great deal of cold rolling, if reheated to a suitable temperature (e.g. 650-700 deg. F., 340-370 deg. C.) during process, will be noticeably superior to ordinary sheet metal with respect to the strain-aging phenomena.

New Officers of American Society for Metals

President, R. S. Archer, chief metallurgist, Chicago division, Republic Steel Corpn.

Vice-president, E. C. Bain, assistant to the executive vice-president, United States Steel Corpn.

Secretary, W. H. Eisenman.

Treasurer, William P. Woodside, vice-president, Climax Molybdenum Corpn., Detroit.

New Trustes to serve two-year terms:

Samuel Spaulding, American Brass Co., Waterbury, Conn.

Reid L. Kenyon, research metallurgist, American Rolling Mill Co., Middletown, Ohio.

Hardening Characteristics of 1 Per Cent Tool Steels

IN a study made in 1930 Davenport and Bain concluded that the structure and hardness developed in a quenched steel is primarily dependent on the particular temperature at which austenite decomposes during the quenching. The hardenability of a steel was therefore pictured as being determined by the stability of a quenched austenite in the temperature range of 1110 to 930 deg. F. (600 to 500 deg. C.), the upper range in which austenite is most prone to decompose and in which its decomposition products are relatively soft. If the austenite of a particular steel is relatively stable in this temperature range and can be cooled through this range by a mild quench, then it decomposes only in the range below 300 deg. F. (150 deg. C.), the product of decomposition is martensite and the steel is fully hardened. Such a steel may, therefore, be called a "deep hardening" steel as compared with another the austenite of which is less stable in the range of 1110 to 930 deg. F. and which, therefore, does not fully harden under identical quenching conditions.

Bain further clarified the conception of hardenability by suggesting that the factors that determine the relative stability of austenite in the temperature range of 1110 to 930 deg. F. are (1) its chemical composition and (2) its grain size.

The conception of the hardenability of tool steel as being dependent upon austenitic grain size rapidly became widely accepted. The influence of the "initial structure" of the steel (the structure prior to heating for hardening) upon the austenitic grain size, and hence upon the hardenability, was also recognized by those most active in developing the theories of grain-size effects.

The influence of the initial or prehardening structure upon grain-size and grain-growth characteristics of austenite in and above the usual ranges of hardening temperatures for a number of steels was given special attention in a paper on the "Hardening Characteristics of 1 Per Cent Carbon Steels," presented at the Chicago convention

by T. G. Digges and Louis Jordan, metallurgical staff, United States Bureau of Standards, Washington.

Two commercial 1 per cent carbon tool steels were selected from widely used brands of one foreign and five domestic manufacturers. Selection of the two steels (one with controlled grain size and the other with non-controlled grain size) was made for their widely different depth of hardening characteristics. Specimens of each steel were prepared with three different initial structures, viz., spheroidized cementite, coarse pearlite, and sorbite, and a study was made of the effect of these initial structures on the austenitic grain-cooling rates. These data also made possible a direct comparison of the relations between austenitic grain size and critical cooling rate of the two steels over a range of quenching temperatures of 1425 to 1775 deg. F. (775 to 970 deg. C.).

For quenching temperatures below that at which all the carbon is completely dissolved in the austenite, both austenitic grain size and critical cooling rates are influenced to a large degree by the initial structure of the steels. Above this temperature each steel approached both a grain size and a critical cooling rate which was characteristic of the steel regardless of its initial structure.

At the highest temperature, i.e., 1775 deg. F. (970 deg. C.) the characteristic grain size was smaller and the characteristic critical cooling rate was higher for the steel known to have been made under conditions producing so-called controlled grain-size steel.

In the correlation of austenitic grain size with critical cooling rates, the steel with non-controlled grain size showed a marked effect of grain size throughout the entire range of quenching temperatures. The influence of the initial structure was also evident at the lower quenching temperatures.

The critical cooling rate of the controlled grain-size steel changed very appreciably with little or no change in austenitic grain size. At the lower quenching temperatures difference in carbon content and carbon distribution in the austenite may be the controlling factors, but at higher temperatures oxides or carbides introduced for grain control are probably the effective fac-

The First and Last Shows Compared

THE National Metal Exposition contrasted sharply with the first exhibition of the American Society for Metals, then called the American Steel Treaters' Society, held in Chicago in September, 1919. The 1935 exposition staged in the huge International Amphitheater at the Union Stock Yards, Chicago, comprised 225 separate exhibits. The first show, held in the Seventh Regiment armory, Thirty-fourth Street and Wentworth Avenue, Chicago, consisted of only 60 exhibits. W. H. Eiseman, now secretary of the American Society for Metals, was then business manager of the "steel treaters."

The original officers of the American Society for Steel Treating: President, T. E. Barker, production manager, Miehle Press & Mfg. Co., Chicago; first vice-president, E. J. Janitzky, metallurgical engineer, Illinois Steel Co., Chicago; second vice-president, D. K. Bullens, consulting engineer, Cann & Saul, Royersford, Pa.; secretary, Arthur G. Henry, metallurgist, Illinois Tool Works, Chicago; treasurer, A. F. Boissoneau, assistant manager, A. Finkl & Sons Co., Chicago.

Design, layout and materials used for the display booths struck a "modern" note which is unusual in expositions of this character.

tors in changing the critical cooling rate.

The initial structure of the controlled grain-size steel exerts an influence on the grain size-critical cooling rate relations at both low and high-quenching temperatures.

Determinations made on non-controlled grain-size steel indicated that the critical cooling rate of this steel with austenitic grains containing carbon above eutectoid composition is lower than that for the same steel with grains of the same size containing about eutectoid proportions of carbon.

Pickle Pitting by Electrolytic Potentials

CERTAIN pearlitic alloy steels, pickled after annealing, show pitted areas of varying sizes and depths, an inverse ratio apparently existing between the size of area and the depth of pitting. The boundary of the pitted area is frequently marked by a deep, narrow line of demarcation, indicating electrolytic action.

The results of an investigation of pickle pitting by electrolytic potentials as affected by scaling temperature were given in a paper presented by C. H. McCollam and D. L. Warrick, the Timken Steel & Tube Co., Canton, Ohio.

S. A. E. steels 4615 and 52100, together with a carbon molybdenum steel, were selected for test because of their diversity of composition and wide use in the automotive and other industries where surface finish and size are important considerations. Pickling was done in both sulphuric and sludge acid solutions, acid concentration being 7.6 per cent.

Potentials of the scaled and steel samples were determined separately against a normal calomel half cell as a reference electrode and the electrical potential was calculated by algebraic difference. Values were recorded at one-minute intervals during the first five minutes of immersion.

In the case of the samples tested, a temperature interval exists through which the difference in potential between the scale and the clean metal shows an abrupt rise. This rise does not occur at exactly the same temperature for all steels. Above 1500 deg. F. a potential difference of approximately 0.6 volt exists. Close proximity of the transition temperatures to the Ac points of the steels investigated is also noted.

Results indicated that pickle pitting is frequently caused by an electrolytic couple set up between scale-free areas and scale formed above a certain temperature. When scale is formed below the transition temperature, neither the difference in electrical potential nor the depth of pitting from this cause is significant. When this temperature is exceeded, the difference in potential results in a galvanic action between the scale and the metal, which proceeds at the expense of the cleaned metal surface. The magnitude of the resulting pit is a function of time and current density.

Mechanical scale breaking, whereby large areas of clean metal are exposed to the electrolyte, will reduce the current density and thereby decrease the intensity of action. A pickling inhibitor does not satisfactorily dampen the electrolytic action that is responsible for pickle pitting. After the scale has been removed, the inhibitory effect begins to assert itself, but it is apparent that even then there is a slow preferential attack of the pitted areas, probably due to the roughened surface of the pit.

The authors also found that any method, such as a mechanical scale breaking prior to pickling, which tends to reduce the current density on the exposed areas in the pickling bath, tends to lessen the depth of the pickle pits on the finished product.

Welding Society Sessions

THE sessions of the American Welding Society were replete with both theoretical and practical contributions to the accumulated fund of knowledge relating to the welding art.

A description of the fabrication of composite dies, illustrated by slides, was given by K. Janiszewski, Superior Steel Products Co., Milwaukee. His company makes punches and dies, the inside sections of which are cut out of tool steel plate by an oxy-acetylene torch, while the outer section is made of machine steel. The inside section is set into the outer section and joined to it with a continuous weld. The die or punch is hardened in the regular way and the machine steel remains soft, making subsequent machining or drilling easier. Distortion after hardening is corrected by stretching or squeezing. Fabricated composite dies can be altered and remounted, whereas solid tool steel dies must be scrapped when new dies are designed.

Welding Low-Alloy Steels

IN a symposium on the welding of low-alloy steels A. E. Gibson, Wellman Engineering Co., said that the high physical values of these steels are obtained, in most instances, with relatively low carbon content, which makes them very adaptable to welding, since the objectionable air hardening experienced in welding steels of the higher carbon range is avoided.

A saving in weight of 30 to 50 per cent can be obtained through the use of low-alloy welded structures in place of previous designs of low-carbon steel. Specifically referring to his company's redesigned drag line buckets, he said that by using high-tensile chromium, manganese, silicon welded steel with a maximum of 0.20 per cent carbon and a minimum 60,000 lb. yield a weight reduction of more than 30 per cent was effected.

In discussing the welding of low-alloy steel plates J. C. Holmberg, chief metallurgist, Struthers Wells-Titusville Corpn., prophesied that the day will soon come when ordinary mild flange steel will be largely displaced in the welding industry. Practically all of the makers of low-alloy plates, he said, are now able to supply electrodes of suitable composition for the welding of their products. Many of these are so balanced that the analysis of the deposited metal will be very similar to that of the plate.

In welding these steels Mr. Holmberg's company follows the same practices, with slight modifications, as with plain carbon steel. The new materials have a higher elastic limit and it follows that rigidity is greater, so that extreme care must be taken in assembling component parts. If possible, straightening or reforming should be prevented, as areas adjacent to the weld prior to final heat treatment are often appreciably harder

and do not lend themselves to plastic deformation in the same way as mild carbon steel. Through the use of carefully selected electrodes the physical properties of the plate material are being regularly duplicated.

Howard L. Miller, Republic Steel Corpn., cited numerous examples of the successful welding of copper-nickel-molybdenum steel in the fabrication of truck tanks and dump bodies for highway transportation of gasoline, fuel oils, ink and for solid commodities, such as coal, ice and building materials, as well as for rubbish and garbage.

More than one hundred welded tanks for the transportation of gasoline and fuel oil, using this steel, are now in service. No. 12 gage heads and No. 14 gage shells are sufficiently strong to carry the load and these sheets are three gages thinner or about 33 per cent thinner than common steel sheets for the same loading.

The same kind of high-tensile steel with a higher carbon content (0.25 per cent as against 0.095 per cent in the fuel oil tanks) has been successfully used for heavy-duty dump bodies. He showed an illustration of a large coal truck body in which the weight had been reduced, through the use of this material, from 5000 lb. to 3365 lb. The truck has a rated capacity of 11 tons and the pay load increase is about 10 per cent. The truck body has been in service nearly two years, making 10 to 15 trips a day.

All of the welded fabrication on these jobs has been done with arc welding and the use of heavy coated wire. Some of these wires use regular direction and some reversed polarity.

Symposium on Distortion

IN a symposium on ways of minimizing distortion J. T. Phillips, Foster Wheeler Co., outlined a method of preventing distortion of longitudinal seams in welded pressure vessels. This is the single "U" groove method. The out-of-roundness that occurs with this procedure seldom exceeds one-half of the tolerances allowed by the codes, and the extra time taken to prevent the usual sinking inward of the seam during welding is much less than the time taken in reforming a distorted cylinder. The extra expense of stress-relieving the thicker walled cylinders prior to reforming cold is eliminated, and instead of the seam distorting the cylinder is uniform in radius at the welded joint itself.

In the Foster-Wheeler method the cylinder is distorted at the seam prior to welding by the use of supports, making the inside diameter at the seam greater than the specified diameter. The edges of the plate are formed to the same radius as the rest of the cylinder rather than to a slightly larger radius, which is sometimes done to allow for distortion, since the company has found that better results are obtained in this way. If the first cylinder of a group is not as round as expected after welding, the length of the supports can be varied slightly to obtain the desired results on subsequent jobs. The range in plate thickness most suitable for this method is from 1 to 2½ in.

George W. Hettrick, Anchor Welding Service, Inc., Chicago, related how distortion is prevented in maintenance welding jobs. Practically all heavy cast iron machinery parts, he said, should be preheated before welding. The principal reasons for this are to eliminate distortion, take care of expansion and contraction and to secure a sound machineable weld. Preheating, moreover, is a great saver of oxygen and acetylene. The most successful fuel for preheating is charcoal, because of its slow starting and uniform heat. However, in some cases of small sections city gas and compressed air, or kerosene blow torches, are used with success. Slow reduction from the welding temperature to the cold stage is as important as preheating to welding temperature.

Heavy sections are tack-welded in place before preheating. This method consists of lining up the casting to be welded and after both halves have been properly shimmed and the casting has been checked for alinement the electric arc is used, with tacks placed at 4 or 5-in. centers. Should the break fail to close up tight before tacking, because of small loose particles of metal in the fracture, it will be found that as the arc weld cools it draws the two sections together making it difficult at times even to locate the hair-line crack which remains. It is important, he emphasized, to obtain perfect alinement in the parts that are welded.

Large coal truck body, all welded from low alloy, high-tensile steel, has been in service for nearly two years without requiring repairs.

J. H. Blaha, General Household Utilities Co., outlined methods used to prevent distortion in welding No. 20 gage steel food liners. In the case of one type of liner butt welding is used. No welding rod is employed because it would raise up high spots which would have to be ground and grinding would likely disclose pinholes to which porcelain could not subsequently be applied. The skill of the welder is exceedingly important. He must hold the torch at exactly the right angle so as not to burn holes in the metal.

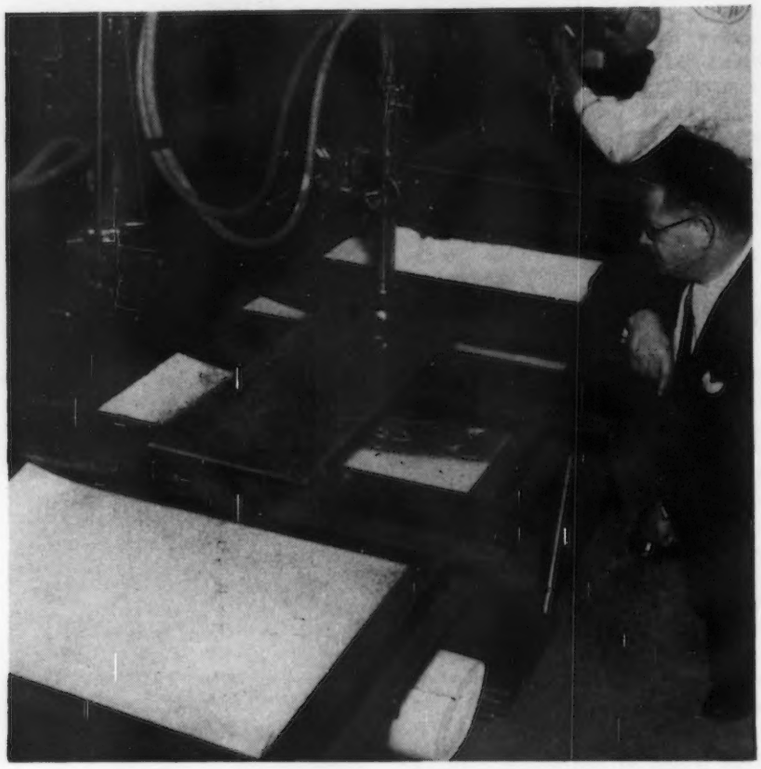
In welding another type of liner the overlapping edge of one of the pieces serves in place of a welding rod. Heavy jigs, made of seasoned cast iron as a protection against warping, are used for this work. The jigs are made heavy to take the heat away from the work

as rapidly as possible, thereby protecting the light-gage metal from distortion. The jigs are periodically checked for warpage.

Welding All-Metal Radio Tubes

The use of resistance welding in manufacturing steel radio tubes was described by M. L. Eckman, research engineer, Thomson - Gibb Electric Welding Co. The assembling of the new steel tubes by electric resistance welding is much speedier and more economical than on the older type tubes. Speeds of from 25 to 30 per minute are now being obtained, with higher speeds possible as operators become more proficient.

Assembling by resistance welding is held to an exactitude not possible with glass construction. Steel tubes have all the strength and sturdiness inherent in steel over glass. Greater accuracy in manufacturing is possible because the steel stampings that go to make up the assembly can be worked to precise limits and at higher speeds. The steel tubes are smaller in diameter than the glass tubes. The outer shell of steel requires no extra shielding as the tube acts as a shield in itself, being integrally grounded.



Secretary Eisenman of the American Society for Metals is interested in one of the numerous educational and practical demonstrations at the exhibition.

Resistance Welding of Copper Alloys

IN resistance welding copper alloys it is necessary that the metal be melted at the time the two parts are given their final push together, stated Ira T. Hook, research engineer, American Brass Co., Waterbury, Conn., in a paper presented in the final session. Straight resistance butt welding is not well adapted to the welding of copper alloys. Flash butt welding, on the other hand, offers a very good way of uniting rods, sheet edges and shapes. The metals are brought into contact with the current on and the consequent arc is allowed to play across the faces until the metal is molten—in from a fraction of a second to perhaps 3 sec.—and the final push-up is made quickly and lightly. It must be made quickly to catch the faces while the metal is still molten and lightly to avoid too great an upsetting of the metal while it is in the hot short condition.

The copper alloys do not possess a long pressure weldable temperature range similar to that of iron or low-carbon steel. The latter becomes plastic for several hundred degrees before it actually melts. In this plastic condition welds in steel can be made by pressures in a rather wide range of intensity. With the copper alloys, this pressure weldable range, while the metal is still in a plastic state, does not obtain.

The resistance butt and flash welding machines commonly built for welding steel usually do not have the light pressure and fast action that is needed for the successful flash welding of the copper alloys. There is no reason, however, why such skill cannot be built into a machine, Mr. Hook stated.

Where the metal is confined, as it is in a spot weld or a seam weld, which is usually a series of spot welds from 10 to 20 to the inch merging one into the other, the same conditions obtain, i. e., the metal must be melted and the push-up quickly and lightly made. Thus the pressure between the welding wheels should be very exactly controlled and the vertical guides for the movable spindle provided with roller bearings so that no part of the welding wheel pressure will be lost in friction. Various speed changes and various heat taps should be provided. The timing of the heat pulses may be effected mechanically or better still by the use of thyratron tubes or a photoelectric cell.

Owing to the high electrical and thermal conductivity of the low zinc brasses, commercial bronzes and beryllium coppers, a capacity of 150 kva. is usually required. With the Everdurs, aluminum bronzes, phosphor bronzes, common brasses, silicon brasses, nickel silvers and cupronickels which have lower heat and electrical conductivity, a lower capacity machine will be found satisfactory.

Since the welding operation is not accompanied by chemical change, the short-time heat pulses so necessary with some of the ferrous metals are not so essential with most of the copper alloys. However, a short heat-on period is desirable on the precipitation hardening alloys such as beryllium copper in order to avoid softening of the metal around the weld. Moreover, fast welding speeds are beneficial in such alloys as the Everdurs and the silicon brasses, as the quick freezing results in a finer grain.

Year's Achievements in Theoretical And Practical Metallurgy

PAPERS presented before the Iron and Steel Institute of Metals Divisions of the American Institute of Mining and Metallurgical Engineers were of prime interest to Metal Congress visitors. Each division held separate technical sessions at the Palmer House, Chicago, with the exception of Wednesday afternoon when the meetings were held at the International Amphitheatre in order to give members an opportunity to survey the more than 200 exhibits located there.

The papers presented before the Institute of Metals Division were devoted for the most part to reactions in alloys, general constitution data and reviews of gas-metal systems. A paper by A. U. Seybolt and C. H. Mathewson examined the solubility of oxygen in solid cobalt and also reported on the upper transformation point of the metal. The solubility of oxygen in solid cobalt was measured over a temperature range of 600 to 1500 deg. C. The method employed consisted in soaking ⅛-in. thick plates of electrolytically deposited cobalt of 99.5+ per cent purity in air until saturation of the metal by oxygen had occurred. The end point for saturation at the various soaking temperatures was determined by repeated soaking and analysis until the oxygen content had reached a constant value.

The considerable discontinuity in the line of solid solubility at 875 deg. C. was correlated with the high-temperature crystallographic transformation in cobalt, which was discovered to occur by resistivity measurements at 850 deg. C. in the oxygen-free metal.

An expression based on the laws of dilute solutions was found to generalize the solubility data, thus offering good evidence that the experimental observations define a true condition of equilibrium.

• • •

E. C. TRUESDALE, R. L. Wilcox and J. L. Rodda reported on an investigation of the zinc-rich portion of the system iron-zinc. New values for the solubility of Armco iron in high purity zinc were obtained by three direct sampling methods at temperatures between 425 deg. and 875 deg. C. These data are lower than all previously published values, obtained from primary cooling curve arrests. The solid solubility of Fe in Zn was investigated by microscopical, electrical conductivity, X-ray and magnetic susceptibility methods, but only the microscope gave useful results. The eutectic temperature was determined from differential cooling curve arrests. The two peritectic temperatures were relocated by the authors at new high values by cooling curves, but especially by heating curves which were more accurate.

The zinc-rich portion of the system was thus fixed as follows: solid solubility of iron in zinc, between 0.0009 and 0.0028 per cent; melting point of zinc, 419.45 deg. C.; eutectic temperature, not less than 419.40+ 0.05 deg.; lower peritectic, 672+ 1 deg.; upper peritectic 782+ 1 deg.; solubility of iron in molten zinc, 0.018 per cent at 419.4 deg. C. (the eutectic), 3.0 per cent at 672 deg.; 7.4 per cent at 782 deg., and 9.2 per cent at 875 deg.

All previous data bearing on the iron-zinc system were critically reviewed and the equilibrium diagram was brought up to date by these three investigators.

• • •

THE influence of lattice distortion on diffusion in metals constituted the subject reported on by V. G. Mooradian and John T. Norton. The relation of the recovery temperature and the temperature of easy diffusion were investigated in the case of Cu-Ni, Cu-Au, Ag-Au and Ni-Co. Sheets made up of alternate electrodeposited layers were used and these sheets were examined by X-ray methods. It was shown that in every case recovery precedes diffusion. Thus the lattice distortion was shown as not being able to aid diffusion but it was pointed out that it can either prevent it or have no influence. The results reported were of a preliminary nature.

• • •

THE quenching stresses and the precipitation reaction in aluminum-magnesium alloys were considered in a paper prepared by R. M. Brick, Arthur Phillips and A. J. Smith. These authors found that the lattice parameter values of quenched rods of pure aluminum containing up to 17 per cent magnesium in solution indicate that surface stresses may be developed to about a maximum of 32,000 lb. per sq. in. The magnitude of the stress is a function of the atomic per cent of alloying element in solution and the physical properties of the alloy, considering all quench-

ing variables as constant. Above 6 per cent Mg, the developed stress generally exceeded the strength and the metal cracked. With a lower magnesium content, repeated quenching plastically deformed the surface. The speed of the precipitation reaction taking place upon reheating supersaturated alloys was studied by these three men in relation to the degree of supersaturation, temperature of reheating, degree of strain and grain size of the alloy. Each of these factors apparently affects the rate in conformity with the fundamental processes of nucleation and diffusion. A comparison was drawn between the diffusion rate of the small copper atom and the relatively large magnesium atom. Particularly in the latter case, unless the diffusion rate is accelerated, the lack of sensitivity of the back-reflection X-ray method prohibits its use in studying the early states of precipitation.

• • •

A FEW notes on the crystallization of copper were offered by Alden B. Greninger. Orientation relationships between large neighboring grains in copper polycrystals (slowly cooled from the melt) were determined by means of back-reflection Laue X-ray photographs. Several orientation relationships corresponded to octahedral twinning; "near twin" and "near parallel" relationships were also found. Experimental results obtained from a study of mosaic structure of copper single crystals were summarized, and the author made an attempt to correlate these results with those obtained from the study of polycrystals.

• • •

W. P. SYKES, Kent R. Van Horn, and C. M. Tucker reviewed the results of a study made by them on the molybdenum-carbon system. In this investigation, alloys of molybdenum and carbon in the range of composition from 0 to 10 per cent carbon were studied by means of microstructures and X-ray photograms.

It was found that molybdenum dissolves in the solid about 0.09 per cent carbon at 2100 deg. C. The beta phase corresponding to Mo_2C has a homogeneity range between 5.3 and 6 per cent carbon. The hexagonal close packed lattice of beta is expanded by the interstitial introduction of carbon atoms in the field of homogeneity. The alpha-beta eutectic containing about 1.8 per cent carbon melts at 2200± 25 deg. C.

A higher carbon intermediate phase, gamma, was observed in 5.36 per cent carbon alloys which had been heated above 2450 deg. C., and this phase predominated in the range between 6 and 10 per cent carbon. This phase appears to form as the solid product of the peretectic reaction by which beta decomposes when heated above 2400 deg. C.

• • •

THE thermal and electrical conductivities of copper alloys were two subjects examined by Cyril Stanley Smith and Earl W. Palmer. These two men determined the thermal and electrical conductivities at 20 and 200 deg. C. for the binary alloys of copper with silicon, aluminum, manganese and nickel, and for a large number of ternary and more complex commercial alloys. In the binary alloys, as the amount of added element increases in the solid solution range the conductivities decrease and the Lorenz ratio increases, at first rapidly and then more slowly. The thermal conductivity of the alloys increases with temperature, although that of pure copper decreases.

The ratio between electrical and thermal conductivity varies considerably, but it was shown that all the results at both temperatures for all copper alloys (including those for the binary series with tin, zinc and phosphorus previously published) lie on a single curve when the thermal conductivity is plotted against the product of the electrical conductivity and the absolute temperature. This curve is almost a straight line and intersects the thermal conductivity axis at a small but definite value. The results of all the alloys measured were found to lie much closer to this curve than to any curve of constant Lorenz ratio. Alloys of other metals probably lie on similar curves.

• • •

SEVERAL studies of phase changes during aging of zinc alloy die castings and the changes in the solid solution of aluminum in zinc and their relation to dimensional changes were reviewed by M. L. Fuller and R. L. Wilcox. It was shown that the dimensional changes which are undergone by zinc alloy die castings (A.S.T.M. Alloy No. XXIII) during aging and low temperature annealings are due to changes in the alpha phase. These changes are the segregation from, or the redissolution of gamma in, the alpha phase of the aluminum-zinc system. This relationship was established semiquantitatively by a comparison of dimensional changes calculated from X-ray data on the phase structure with those changes actually experienced. The authors reported that the evidence indicates quite strongly that the beta phase decomposition plays a very minor part, if any, in the aging of this alloy.

• • •

IN addition to these papers on theoretical subjects, a short talk on metallurgy in Norway was presented by Carl W. Volz of the Norwegian Smelting Works, Electric Furnace Products Co., before the Iron and Steel Institute of Metals Division of the A.I.M.E. The speaker reviewed the geography of Norway and its position with respect to the rest of the industrial world, and also pointed out the effect of its geography and climate on the nature of the people and their adaptability as influenced by their environment.

The resources of the country and the history of its early mining developments were described and brought up to date. This, of course, included a brief description of the ore bodies, their locations and the difficulties of the early workings and their present status.

Following this, Mr. Volz reviewed the development of water power in Norway and the reasons for the sudden importance of the hydroelectric developments. The influence of its water power development on the metallurgical industry of the country, with particular reference to the production of aluminum, copper, nickel, iron, steel and ferroalloys was a most interesting portion of the talk. Mr. Volz concluded with a brief review of Norway's economic position with respect to Europe, and the anticipated future trend of its metallurgical development.

• • •

ONE of the important events of the Iron and Steel Division's program was a round table on qual-

ities of pig iron. This feature had its beginnings at a morning session of the 1927 annual meeting of the A.I.M.E. and resulted in so much pertinent discussion that it had to be continued in the afternoon. The American Foundrymen's Association held a round table on pig iron at the Edgewater Beach Hotel in Chicago, which was attended by many foundry and blast furnace men and resulted in much research work by the Gray Iron Institute and large consumers of pig iron. The round table last week was held under the auspices of the joint A.S.T.M.-A.I.M.E.-A.F.A. committee on pig iron qualities. At the meeting last week the blast furnace men pointed out the advances that have been made in the production of merchant pig iron since the first round table in 1927. Also brought out in discussion was the narrowness of the present specifications for foundry and malleable pig iron, and it was shown how closely they are met by the blast furnace men. The foundrymen reported on the improvements in cupola practice and on the technique of gray iron casting.

• • •

ANOTHER feature of the Iron and Steel Division was a paper on temperature measurements with a disappearing filament optical pyrometer, presented by W. E. Forsythe. The author described the different forms of optical pyrometers and the advantages and disadvantages of the different types for measuring high temperatures. In most work performed by the author, a consideration of these advantages and disadvantages led to the selection of the disappearing filament type of optical pyrometer. The necessity for the use of a monochromatic screen with a pyrometer was emphasized, and this led to a discussion of the meaning and use of the effective wave length of the screen.

Methods of calibrating the optical pyrometer were outlined and it was shown that an optical pyrometer can be calibrated just as definitely as any other temperature measuring device. Accuracy tests were included in which the author showed that excellent results can be obtained by even untrained or slightly trained observers with an optical pyrometer of the type under consideration. The various corrections that are necessary in this kind of work were pointed out, including corrections for stray light, for absorption of windows, of smoke, etc.

The troublesome problem of measuring the temperature of bodies that do not radiate like a black body was discussed and the corrections for reducing such readings to the true temperature were given for a number of different materials.

• • •

SOME notes on the origin and growth of graphite nuclei in solid and liquid iron solutions were presented before the Iron and Steel Division by H. A. Schwartz and Wolfram Ruff. The authors studied the number of nuclei capable of growing into graphite aggregates by observing the number of such aggregates per unit volume of alloy. It was found that the number of nuclei in white iron, capable of growth, is a function of the temperature at which germination takes place and also of various melting conditions including the composition of the furnace atmosphere.

The number of nuclei capable of growth during freezing presents a much more difficult problem and was not completely investigated. Some variables of melting practice effective in altering nucleus number in white iron are shown to have similar effects in gray iron. The authors described a means which was devised for evaluating the degree of "spawliness" of secondary graphite and a means was suggested which, though less successful, may be of some value in the same connection for primary graphite. Various theories of nucleation received attention mainly in the light of a selected bibliography.

• • •

A PAPER presented by E. W. Schilling and Harwick Johnson was devoted to the separation of hematite by means of hysteretic repulsion. This paper dealt with the action of hematite when subjected to a polyphase magnetic field. Although hematite is normally considered non-magnetic and does not respond to the usual methods of magnetic separation it has been found that specular hematite is very active in an alternating magnetic field. If this be a polyphase magnetic field, the material can be made to move longitudinally as well as laterally. Red hematite, which normally is not affected even by the a.c. field, when subjected to the proper treatment may be made very active. In fact, particles of treated red hematite are often repelled with such force that they jump 2 to 3 in. in the air. The authors included curves to show the effect on the amount of hematite moved per unit time of changing, field strength, air gap (for various values of excitation), frequency of excitation, magnitude of vibration, frequency of vibration, heat treatment, etc.

Pittsburgh Sponsors Industrial Exhibit

AN industrial exhibit is being sponsored by the Purchasing Agent's Association of Pittsburgh at the William Penn Hotel, Oct. 10 and 11.

Included among those displaying their products are two builders of rolling mill equipment, several steel companies, a glass manufacturer, paint makers, a producer of die blocks and shear knives, outstanding bituminous coal producers, two of the largest manufacturers of steel buildings and steel forms, two leading tool steel manufacturers, the world's largest producer of aluminum and a maker of safety equipment.

In addition, there will be exhibits by a large oil company, an electric manufacturing company, an air brake manufacturer and an outstanding warehouser of steel and steel products.

Listed are leading manufacturers of abrasives and grinding wheels, ferro alloys, brass and copper products, valves and fittings, railroad tires and equipment.

The exhibit is designed to show the complete extent of industrial and service activity of the Pittsburgh district, and will present a remarkable picture of those activities which will be of interest to all Pittsburgh. Admission will be by ticket only. Tickets are available, without charge, through any member of the Purchasing Agent's Association of Pittsburgh.

Five Years of Progress in Southern

By FRANCIS H. CROCKARD**

o o o

IN addition to questions of quality, the subject of cost has greatly altered the Southern furnaceman's viewpoint on many things. We formerly had low-grade but cheap raw materials, but recent developments, such as greatly increased labor rates, have raised the cost, but have not raised the iron content of our ores. This has resulted in the increased use of labor-saving devices and a much closer watch over the economical use of raw materials. A survey of the more important trends of the past few years should, therefore, be of interest.

Raw Materials—Coke

Most blast furnaces are operated in conjunction with a coke plant, but the coke plant operators frequently are forced to keep their eyes on the market for commercial coke, by-products, etc., and to operate the ovens accordingly, with the result that the furnace coke has sometimes suffered. However, there is no reason why good furnace coke cannot be made at all times, and the commercial grades improved along with it.

Recently we have focused a great deal of attention on the improvement of furnace coke, and the results have been felt in improved practice at the furnace. Most Southern coals that are coked for furnace use are of high ash and therein lies our chief concern. Among the disadvantages of a high ash coke are the following:

1. There is less fixed carbon per ton of coke handled.
2. More limestone or dolomite is required to flux it.
3. A high ash coke will tend to have greater variation and hence the grades of iron will suffer.
4. High ash tends to lower porosity.

1. Effect of High Ash on Yield and Cost

The fixed carbon content and the fluxing stone requirements have a direct bearing on cost. Let us consider the effect of a 2 per cent reduction in coke ash. The following is an average burden for a given month:

	Lb.	Lb., Iron
Ore A.....	8,150	2,720
Ore B.....	4,330	1,555
Ore C.....	6,130	2,780
Dolomite ...	3,430	....
	22,040	
Scrap	....	595
		7,650 Fe per charge or 3.42 tons
Coke	9,250	....
Number of charges in month		2,880
Tonnage for month....		9,833
Tons iron per charge..		3.42 (check)
Coke per ton iron.....		2,707 lb.

A reduction of 2 per cent in the ash would mean, roughly, an increase of 2 per cent in the fixed carbon, and hence the furnace could have carried a burden of 22,600 lb. Distributing this in proportion and using enough dolomite to get the same slag ratio, we have:

	Lb.	Lb. Iron
Ore A.....	8,474	2,830
Ore B.....	4,509	1,620
Ore C.....	6,375	2,900
Dolomite ...	3,242	....
	22,600	
Scrap	....	595
		7,945 or 3.54 tons per charge
Coke	9,250	....
Number charges.....		2,880 (Same Rate)
Tons per charge.....		3.54
Tons iron per month..		10,215
Coke per ton iron.....		2,607 lb.

This is a saving of 100 lb. of coke and 53¼ lb. of dolomite per ton of iron produced. The increased tonnage would mean a reduction in overhead per ton of iron. Assuming that coke costs $2 a ton, dolomite $0.80 and that overhead is $1.75, then you would save $0.100 per ton on coke, $0.019 on dolomite and $0.070 on overhead, or $0.189 per ton of iron which would amount to $1,930 in the above month. On higher grades of ore the saving would of course be greater, and on higher production the saving in dollars per month would pay for considerable expense to reduce the coke ash.

Effect of Coke Ash on Silicon Control

Another important reason for desiring close control of coke ash is because of its effect on the silicon in the pig iron. The higher the ash is, the more room for variation. Thus consider a coke of approximately 14 per cent ash. This might easily vary from 13 to 15 per cent and frequently will if proper care is not exercised. On the other hand a coke of 4 per cent ash would vary in the same proportion from 3.71 per cent to 4.29 per cent. Since fixed carbon varies roughly inversely to the ash, and if we had a 10,000 lb. coke unit, we would have:

10,000 x 2 per cent—200 lb. carbon variation in first case and 10,000 x 0.58 per cent—58 lb. carbon variation in second case.

Assuming a burden ratio of 2.25, then:

200 x 2.25—450 lb. burden
58 x 2.25—130 lb. burden

Obviously a change in the burden of 450 lb. is much more deleterious to the furnace than a change of 130 lb., but this is what happens when the coke ash changes.

Porosity of Coke

Coke porosity is a very important feature of satisfactory furnace

*Abstract of paper presented before the Iron and Steel Division of the American Institute of Metallurgical Engineers in Chicago, Oct. 1

**Metallurgist, Republic Steel Corpn., Southern District.

Merchant Iron Production* ▲▲▲

operation. When the porosity of our coke was increased from about 44 or 45 per cent to 48 per cent we had a marked improvement in practice. Flue dust losses were lower, grades were better, and coke consumption was materially improved. This is undoubtedly due to better space-rate of combustion and to more efficient gas-solid contact.

Here again we have a very important function of the ash, for by reducing the ash you may improve your porosity.

Oven operation is of course important in the control of porosity, but for a given operation the ash is apparently the controlling factor.

Effect of Coke Size

The sizing of coke is an important factor in furnace operation, just as the sizing of ore is. During the depression it was frequently necessary to use in the furnace all coke that was not sold commercially, with the result that at times only one size was available for the furnace, while at others all sizes except breeze had to be used. A study of this period, therefore, gives an idea of the results of this practice.

These figures are furnace months arranged in the order of increasing coke consumption. This latter figure will look very high to the Northern operator, but is accounted for by our large slag volume (about 2000 lb. per ton of iron) and the low percentage of iron in the burden (about 35 per cent to 40 per cent). Even so, more recently due to the improvements we are discussing, these figures have been improved by 300 or 400 lb.

From the table it is quite clear that when a sizing effect is obtained by charging only one or two sizes, the results are much better than when all sizes are mixed together. By crushing coke to proper size and charging one size only to the furnaces we have greatly reduced our coke consumption figures in the past year, so that a figure of about 2200 would be more representative.

It is unfortunate that the mechanical layout of our stock house does not permit us to rescreen the breeze from the coke before it enters the skip, as undoubtedly even further savings could be affected, as indicated by experience in other places.

Improvement in Coke in Past Few Years

Two major improvements in coke preparation in the past few years have been:

1. Reduction of coke ash by improved washing.
2. Pulverization of coal before coking.

There is of course nothing fundamentally new in either of these developments, but considerable time and money has been spent on improving the coke by these two methods.

The necessity for low ash and uniform ash has already been pointed out. We have recently been able to reduce our coal ash by 1½ per cent by the installation of new jigs at the mines. This is of course a coal mining problem, but it is one which affects the furnace man.

Very careful control of the washing operation is essential if good results are to be obtained. The coal should be crushed to a fine size in order that the washing operation will have opportunity to separate the bone and the slate. Depth of beds and angle of bed bottom are matters of great importance, and the proper regulation is found only through constant trial with very close checking of results, for every coal has a different action. A float control is provided which regulates the feed of coal automatically. The chief problem in this operation is not *low* ash alone, but *uniformly* low ash together with a reasonable washer loss.

Pulverization of coal before entering the ovens has been introduced to blast furnace coke plants during the past few years. We use a rotary hammer mill for pulverization, and from 60 per cent to 80 per cent of the product will pass through a ⅛-in. screen depending

Figures for Furnace Months in Order of Increasing Coke Consumption

Hot Blast, Cu. Ft. per Min.	Wind, Cu. Ft. per Min.	Sil., Per Cent	Coke, Tons	Number of Coke Sizes	Coke Ash, Per Cent
1,170	38,700	2.54	2,707	1.5	14.17
1,135	38,700	2.42	2,712	1.75	14.16
1,250	35,700	3.92	2,742	1.0	13.88
1,170	36,500	2.20	2,742	2.33	13.86
1,225	40,800	2.53	2,790	3.00	14.40
1,200	36,500	2.28	2,795	1.0	13.88
1,170	36,100	2.10	2,826	2.33	13.86
1,190	36,900	2.34	2,850	3.33	14.04
1,280	39,700	2.41	2,859	2.5	13.78
1,180	36,500	2.26	2,891	4.0	13.56
1,175	38,500	2.35	2,894	2.5	13.77
1,170	40,800	2.34	2,939	3.00	14.40
1,220	39,400	2.47	3,002	2.33	13.78
1,220	36,800	3.21	3,016	4.00	13.56
1,175	33,500	2.40	3,033	4.0	13.96
1,070	36,800	2.49	3,259	3.33	14.04

on operating conditions, coke desired, etc.

Ores

Sizing of ores to two or three sizes and charging separately into the furnace is being done by two or three Southern companies with admirable results. Although our company has not gone quite this far, we nevertheless are crushing all hard ores through a 1-in. crusher. This gives the effect of sizing, only one size being used and that one small. This has greatly improved our practice.

Flue Dust Control Through Ore Preparation

The past five years have seen much greater interest in flue dust control in the South. The two most important factors in flue dust control are furnace design and preparation of ores. Crushing and sizing of ores at present probably have some effect on flue dust control. The properly sized ores work better in the furnace and hence prevent channeling and irregular movements which tend to increase dust loss.

Dust loss has been reduced from around 300 lb. per ton to where 100 looks high, and some plants are getting below 50. It is difficult to determine which proportion of this is attributable to ore preparation and which proportion to furnace design.

Furnace Lines

Furnace lines have always been a subject of great interest to operators. The general tendency is toward a steep bosh angle and an increase in stock line diameter, especially the latter.

Several important changes in design are indicated in the 1935 lines. The height of the furnace was increased 5 ft. 3 in. This was done primarily as a means for flue dust control. If the ore column is the same height in the two furnaces, then the taller furnace will have a space of 5 ft. greater distance for the gas to travel and hence give the gas more opportunity to drop dust particles. In other words, this space acts as a primary dust catcher, but the dust returns directly to the furnace and does not have to be rehandled.

Another change is the introduction of the gas passage space outside the hanging armor. One of the chief causes of dust production is the increased velocity of the gas when the bell is lowered, due to the bell cutting off a portion of the available outlet to the offtakes. By the use of the gas passage space, the effective stock line so far as gas is concerned is 18 ft. 10 in. with an area of 50 sq. ft. that is unaffected by the position of the bell. This large area would give an entirely different distribution of the ores if it were made by simply widening the top, but the hanging armor reduces this area to 17 ft. so far as the incoming ore is concerned.

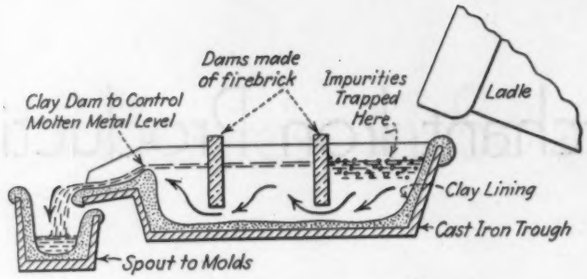


Fig. 1—Pig machine pouring trough for skimming.

On this furnace also four uptakes were installed at an angle of 45 deg. in place of the two former uptakes at 90 deg. Thus the offtake area is doubled, with consequent reduction of gas velocity and hence lower dust loss. The 45-deg. angle is also effective in returning the large lumps of coke, ore and scrap, which were sometimes thrown out, to the furnace.

Another item of interest in this furnace is the installation of examination holes. An extension of the uptake nozzles was brought up close to the receiving hoppers and removable covers placed thereon. It is thus possible to work the furnace down on the rod, take the wind off, open the boxes and inspect the condition of the brickwork, armor, filling, etc., safely.

The general tendency has been toward a very steep furnace, with a bosh angle well over 80 deg. and increasingly longer straight section. However, since starting the finer crushing of the ores and using generally smaller but more uniformly sized raw materials of all kinds, there is a strong probability that the next change will be back toward a flatter bosh. However, the wider stock line seems to be a step in the right direction and it is apparently here to stay.

A New Bosh

An important contribution to furnace design has been the development of what is practically a permanent bosh. This bosh is simple in design, yet is very strong and has proved most satisfactory in our five years of experience with it.

The main feature of the bosh is a ⅞-in. firebox steel plate which is made up in 12 sections butt-welded by an electric arc to form the circle. A gap of an inch and a half is left at the bottom to provide room for expansion or possible upward movement of the tuyere jacket, and there is a half-inch packing space between the plate and the brickwork. Particular attention is called to the design of the block housings. These extend from 4 to 6 in. inside the furnace and form a support for the cooling blocks, thereby eliminating the leverage on the end of the blocks. The bottom of the housing does not touch the block its entire length, but only at the ends, and there is a tapered fit at the outside of the housing so that the blocks may be easily removed when necessary. A keeper is inserted in the projecting lugs as a safety measure.

If it is desired to change the bosh angle, this may be done by merely changing the length of the cooling blocks.

The permanence of this bosh is shown by the fact that we have relined both furnaces several times since it has been installed but have not yet had to reline the bosh, in spite of the fact that we have made a great deal of 15 per cent ferrosilicon which is very hard on furnace linings.

Distribution

The important subject of distribution has not been forgotten. Most, but not all, of the Southern furnaces are now using the McKee distributer.

Work has been done on scale models by the Bureau of Mines on the subject of distribution, but a study that was made on an actual furnace that was made last March

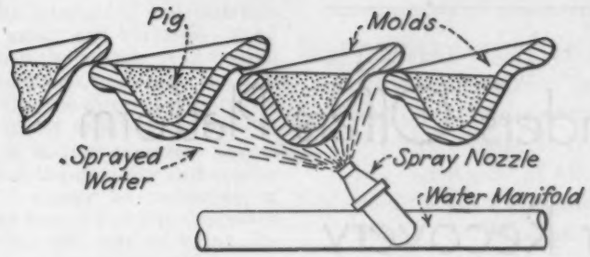


Fig. 2—Under-mold or indirect cooling.

may be of interest. The furnace had not been blown in, and before lighting it off it was filled with coke to a point 24 ft. 6 in. below the bell. We then went inside the furnace and took observations on the distribution. After each lowering of the bell this was repeated until the furnace was full and in this way a good idea of the way the ore and coke tends to fall was obtained. This was, of course, more accurate than a scale model, but did not have the effect of the wind going through it. It is doubtful if this would have any pronounced effect.

This test showed that if the furnace is down on the rod, the ore tends to pile in the center. At about 14 ft. from the bell it flattens out, and from there on up there is a decided cup toward the center. Larger lumps tend to segregate in the middle all the way, showing the normal tendency to an open center.

Quality of Product

A very important development in the past five years in the South has been the market improvement in the chemical characteristics of the iron produced.

The normal pig iron now produced has phosphorus of about 0.75 per cent as opposed to 0.85 per cent a few years ago and the manganese has been increased from about 0.35 per cent or 0.40 per cent to approximately 0.60 per cent. Furthermore, there is an increased demand for pig irons of special analysis that require these elements to be much lower or much higher as the case may be, while still keeping the silicon in a fairly narrow range.

This requires very careful selection and analysis of ores and very uniform operation of the furnace.

Improvement in Physical Appearance

When machine cast iron was first introduced in the South, it was soon found that this iron would have to have a very finished appearance in order to have a market.

The first improvement in machine cast iron was the introduction of triple skimming. The iron is first carefully skimmed at the furnace before going into the ladle. While it is in the ladle certain included impurities have opportunity to rise to the surface. These are removed as the iron is poured at the pig machine by two more skimmers, as shown in Fig. 1, and may be raked off from time to time. A few scruffy pigs are usually made at the beginning of pouring and these are removed from the car before shipment.

Some customers prefer a more open grain than is usually seen in machine cast iron, and for this reason we developed a method of slow cooling that gives a fracture similar to that of sand cast iron. This consists in running the strand fairly slow, and not putting water on the pigs at the beginning. About 30 ft. from the end of the strand, water is sprayed on the bottom of the molds, as shown in Fig. 2. In this way the heat transfer is from the pig *through* the molds to the water, and hence is much slower. This gives the pigs time to deposit graphite and form the usual fracture. About 15 ft. from the end, water is turned on the top of the pigs to insure complete solidification and absence of bleeders, and to cool the pigs so that the cars will not be damaged by heat. Final cooling is given by water sprays in the car after it has left the molds.

An important feature of the pig machine operation is the coating or wash on the molds. One of the most satisfactory is a mixture of half pulverized coal and half hydrated lime. Molds are first cleaned by a steam spray and then the facing mixture is sprayed on and the facing dried by passing over a gas flame. A mechanical brush removes the thick coating at the shoulders of the mold, as this does not always dry thoroughly and is apt to cause boiling of the iron in the mold. This type of wash on the molds gives a very smooth looking pig similar to any good casting and helps to eliminate "stickers."

There are many other factors in making a smooth and satisfactory pig. Close watch must be made on the amount of water used both on the strand and in the car, as this is one of the chief factors in determining the rate of cooling, the other being the rate at which the strand moves. The rate of pouring the ladle is also of importance and must be coordinated with the movement of the chain in order that the proper size pig will be made. If pigs are cooled too quickly they will form a chill and be apt to break on dropping in the car. On the other hand, if they are not cooled quickly enough they will break open and "bleed," changing the weight of the pig, and certainly not adding to the appearance. The weight of individual pigs is of great importance to foundries that charge by bulk instead of weight.

It must be mentioned that in spite of all these precautions, it is still impossible to make good looking iron if the conditions of the furnace are wrong. A furnace that is not moving properly, or the use of badly prepared ores, will change the character of the iron so that all the effort at the pig machine will be in vain to obtain clean product.

In the construction of a steel frame residence in Ottawa Hills, Toledo, Ohio, 46 tons of structural steel will be used, or much more than the average required in building a steel frame house. The fabrication and erection contract has been placed with the Art Iron & Wire Works, Toledo. Carnegie Steel Co. will supply the steel. Myron T. Hill, Toledo, is the architect.

The Steel Sales Corpn., Chicago, Midwestern representative of 16 mills producing sheet, rod, strip, tube, wire welding rod, etc., and non-ferrous metals, has leased the two-story building at 4067 Park Avenue, St. Louis, for a warehouse. The building has 20,000 sq. ft. of floor space.

Ralph E. Flanders Offers Platform For Recovery

Machinery Will Yield Abundance, He Tells Mining Congress, When Artificial Restraints on Competition Are Removed

ELEMENTS of a proposed policy for the proper operation and control of our machine civilization were listed by Ralph E. Flanders, president, Jones & Lamson Machine Co., in an address before the recent annual metal mining convention, Western division, the American Mining Congress, held Sept. 23 to 27 at Chicago. These elements are as follows:

1. A continuing trust in machinery and organization as the only source of an increased production of goods and services at lower cost—that is, the only source of a rising standard of living.

2. Development of new monetary policies as a basis of stability, wherein the quantity and quality of credit are controlled from the standpoint of an adequate stream of purchasing power, increasing with population and with the rising standard of living.

3. Discouragement of speculative activity and of the monetary, business and employment disorders resulting from it.

4. Preservation of effective competition as a natural means of (a) preventing destructive unbalances in industry, (b) lowering prices and increasing purchasing power, and (c) making governmental control of labor and industry unnecessary.

5. Improvement of Federal Trade Commission practice to protect business from fraudulent competition and consumers from fraudulent goods.

6. Immediate beginning of gradual removal of artificial governmental support for agriculture, labor and industry, so as to permit the necessary redistribution of workers and capital to bring the depressed industries and their dependent population into a safe, natural balance.

7. General encouragement of the production of wealth from productive business.

8. General dependence on the income tax for the expenses of prudent Government.

9. Provision of simple subsistence for the entire population at all times, to be given only in return for honest, useful work for those able to work, by direct support in case of disability by reason of youth, age or ill health; this policy becoming practical for the first time as the preceding policies reduce human need and multiply national resources.

The Machine Has Not Failed

Our aim, said Mr. Flanders, is to produce and distribute to the citizens of this country more goods and services than ever before. We are determined to do this with much less fluctuation in the volume as between good times and bad. We wish to provide a more equitable distribution, being particularly concerned lest any one able and willing to do useful work may find himself deprived of the opportunity and of the resulting wages and sustenance.

There needs be no discussion of the success of modern machines in the production of desirable goods. This is the purpose for which they are designed and their designers have not failed.

In consequence fewer hours of work and fewer workers proportionately are needed for providing the goods which go to make up a generally high standard of living. This leaves an increasing number of people free to provide the services—such as teaching, medicine, recreation, travel, personal service, etc.—which are the particular gifts of an advanced civilization.

But the productivity of our machines is such that they offer a third gift in addition to increased goods and services. For the first time in the world's history they add the boon of leisure, after the physical needs have been supplied. Goods, services and leisure, sufficient for the reasonable needs of all of us—these are made available by our machine-based civilization; and in no other time or place and by no other means have they been made available. Our machines have not failed us here.

Must Combine Abundance and Stability

Stability of performance is another story. In this regard the machine age suffers by comparison with other types of social structure. Machine manufacture offers a high standard of living but unstable enjoyment thereof. Agriculture of the subsistence type offers stability, but on a low scale. The problem is to combine the elements of abundance and stability.

The three salient areas for the determination of effective policy are (1) the financial area, (2) the area of industrial and occupational practice and (3) the interrelations of the various classes of society. In these three areas we must initiate and perfect new policies if we are to mold our social structure into something more desirable than we have endured in the recent past.

In the financial area the effective regulator has been and is money, operating through the profit motive and by the mechanism of competition. The profit motive and competition are not outmoded and harmful phenomena. There is reason to believe that the severity of our crash was in good part due to a perversion of the profit motive and to a large-scale abandonment of competition. Safety will require an intelligent return to both.

Quantity and Quality of Credit Money Must Be Controlled

Money constitutes that flow of purchasing power which is expend-

ed in the production and distribution of goods and services—which flow, when the system is in health, is just sufficient to provide the consumer with the means for purchasing the goods and services offered.

It is a matter of prime importance that the quantity and quality of credit money be controlled, if we are to have a stability expressed in a rising standard of living, instead of an instability which periodically destroys our mechanism of distribution by first inflating and then destroying purchasing power.

Under the new banking law, and under certain provisions of the Glass-Steagall act—which seem to be well adapted to the purpose—we must (1) limit the volume of credit generated by unsafe means for unsafe purposes, as for security speculation; (2) we must keep the total volume of credit employed in business constant except for an annual increment dependent on our population increase and, what is still more important, an additional annual increment for a rising standard of living—say 5 or 6 per cent in all; and (3) we must provide effective and perhaps new means of injecting and retiring the necessary controlling credit directly into business.

The foundation of this generation of safe credit must be the old-fashioned 30, 60 or 90-day loan for financing production and distribution. To provide such loans in sufficient quantity it is necessary that there be willing and safe borrowers; and this in turn requires that political and financial conditions be such as to generate confidence. Confidence is a primary requirement.

But still more credit may be needed. If so, a direct application of credit to Government expenses and the retirement of that credit by taxation offer the most hopeful field for investigation and experiment. But in finance, as in mechanics, we must make sure that our novelties are based on natural law and solid experience.

Controlling Industrial Unbalance

Industrial and occupational unbalance is the second problem requiring a determination of policy. These unbalances are taking place all the time, but are for the most part self-corrective so far as concerns business as a whole, though individual business men are ruined and individual workers are thrown out of employment in the course of the readjustment.

But there are certain times when maladjustments occur rapidly and on a large scale, so that the normal processes of adjustment break down. These large-scale maladjustments are particularly prone to occur during inflation and during depression.

PRESERVATION of effective competition is the best means of preventing destructive unbalances in industry, in the view of Mr. Flanders. Cyclical unbalances, growing out of inflation and deflation, are due to imperfect credit control and not to competition. Regulation of the credit mechanism, therefore, is essential to protect free enterprise from periodic blights. Government control of business when it reaches the point of freezing wage rates, prices and output, perpetuates economic maladjustments and narrows both markets and production.

For unbalanced industry, there are two principles available for remedial policy. The first attempts to conserve the wages, salaries and profits previously derived from the industry. As demand lessens, prices are artificially raised if possible, so that profits may be maintained. Of late more extreme forms of support have been offered by the Government in the form of processing and other taxes.

Now these and other devices may be justified as temporary expedients. The great fault is that such devices maintain prices and still further limit demand so that a vicious circle is generated. What is needed is the natural remedy which shifts men and capital from unprofitable into more profitable undertakings; this process draws the depressed industry toward the level of the whole instead of holding it there by artificial and unstable means.

The Economic Follies of 1935

To extend the argument from the particular to the general, we find, in a survey of economic balance, its failures and its successes, that we are facing a series of prevalent follies, which are not confined to any class, occupation or political party, but ramify throughout our whole social structure. The essential nature of these follies is that they seek to set up permanent controls of prices, wages or output based on the immediate advantage of a particular class. And the result of these follies is that the well-being of society as a whole is thereby disturbed, and the group which seeks its own advantage suffers with the rest of us.

A folly of labor has been to rely on "successful" labor union policy in such industries as the building trades and the railway workers. Wherever and whenever as in these cases, wages are maintained which are out of line with those workers in other fields, costs are so high that these industries stagnate, and the members of the "successful" unions find themselves out of employment.

An endeavor was made to organize the follies of farmer, worker and business man into a complete system under the NRA and the AAA. Aside from the minimum wage provisions and the elimination of child labor — which latter was nearly an accomplished fact before the NRA was organized—we need have no regrets at the passing of the one, or the difficult times in which the other finds itself. A summation of follies is not converted into a successful social system even when blessed by Government.

In attempting to free itself from the hardships of competition, business will find itself with wage, price and production policies which will lessen its market and reduce its profits.

Restriction of Competition Leads to Governmental Control

Furthermore, any endeavor to restrict competition leads directly, and properly, toward governmental control. Competition in price, service and quality is at once the safeguard of the public interest and the best and most natural regulator of employment and production. Industry by itself, or Government acting for it, can never solve the problem of control so that the business unit takes its proper place in a balanced economy.

What Government can do is to furnish business with the solid foundation of a socially organized money system. In addition, through a properly organized Federal Trade Commission, it can eliminate from competition the fraudulent elements whether as between business and business or as between producer and consumer. More important still, it can itself apply the greatest safeguard against governmental usurpation and tyranny—it can keep effective the laws against restraint of trade. When business as a whole, on the foundation of a solid money system, is willing to submit to the rigors of competition to the degree obtaining in the automotive industry, for instance, employment will increase, more and better goods will be sold for lower

prices and governmental control will be an evident impertinence.

How Occupational Balance Can Be Restored

An expansion of industry in this spirit will draw men from the overcrowded industries such as coal mining and farming. The returns to those who leave will be higher than in their old occupations, and the returns of those who stay will be higher as well. In addition the prices of goods will be lowered, and more goods will be made and distributed both to those who stay and those who go.

There is no deadlock. The continued improvement of management and machinery offers the clue. The employment of these factors under competitive conditions is the method. Full employment, adequate leisure, the good wages of an active labor market and lower prices—these comprise the worker's reward, and solve the problems of the depressed industries.

To a considerable degree the question of a more even distribution of wealth is independent of questions of stability and of increase in general wealth. It is possible to have both with great inequalities in wealth. But for continued and increasing functioning of the economic machine it is necessary that the rich and well-to-do shall spend and not hoard. It is most desirable that they shall reinvest a sufficient percentage of their returns to balance the enormous losses of business as a whole, and in addition finance the new equipment needed for providing a rising standard of living to an increasing population. Furthermore, they should be willing to spend freely as so many have, in wise benefactions for the public good. It is even desirable that they spend for luxuries and personal service, and thus keep the flow of purchasing power active. These are the socially necessary uses of wealth. They do not prevent, they help, the social achievements which we set for ourselves.

Undesirable Uses of Wealth

The undesirable uses of wealth are: (1) its devotion to speculation, particularly on margin as a basis for an unsafe credit structure such as has been described; (2) the loaning of wealth to finance speculative operations; and (3) hoarding. These activities militate against our social objectives.

However, though great inequality of distribution may not affect other elements adversely, it is undesirable in itself. Any wise social policy will tend to level up the returns to the lower paid workers by any and all means which do not decrease the total of production and distribution. This proviso is important, for the driving force of individual initiative in its reasonable hope for gain has often been forgotten, and no substitute has yet been found for it. The useful functions of wealth remain as we have described them. They can remain and serve as instruments for leveling up the remaining mass of the population.

In general, all the policies described work toward this end also; and if we add to them the now well recognized principle that the main burden of taxation for the support of a wise and prudent Government shall be borne to a major extent by those best able to carry it, we have the essentials of a wealth control policy which will produce and distribute more goods and services instead of reducing and rationing them to an under-privileged population.

Providing for the Unemployed

The final item of our social policy will be the public provision of work at subsistence wages at all times for those able and willing to work; and the proper maintenance of those in need and unable to work. Thus will the fear of privation be removed from the souls of ourselves and our fellows.

The expenditures required for a thoroughgoing relief policy will be enormous and difficult of financing—as they are now—if violent fluctuations in business are permitted and the increase of taxable income is discouraged. But with stability in our economic order and the encouragement of wealth production, the load will be both diminished in size and more easily borne. This is a consummation eagerly desired by all men of good will, of whatever station, occupation or party.

This is a program of progress, not of reaction. It recognizes the mistakes of the past, draws lessons from them, and moves forward into a better future. It is most important to observe that every element of it can be carried out under our Constitution as it now stands. Those who contend that social progress requires a change in that document are following false doctrines. They seek to arm the Federal Government with new powers of control which we have seen to be fatal to the ends sought, and which in practice will be destructive of Government as we have known it.

Editor's Note: This is a series of observations which, strangely enough, are exactly what they purport to be. In other words, they come from the daily diary of a real boss; a prominent executive in the metal-working industry who prefers to remain an anonymous author.

The Boss's Diary

I saw the start of a $1,000,000 bet yesterday. I took E_____ to a favorably known eastern college for women to enter the freshman class. Immediately she was absorbed in a milling, excited group of 200 flappers, all athrill at the start of four years of college. Calculating Dad began to figure—200 flappers, if they last the course, at something like $5,000 apiece is a $1,000,000 bet spread over four years that the course will do them good. It's a bet every way from the ace. Two hundred parents, guardians or what have you, betting $1,000,000 on the next generation—the dignified, nationally known woman president of that college taking up our bets, as they lay, that she can pump $1,000,000 of value into our offspring. Two hundred thrilling daughters, care-free as the summer's zephyrs, unconsciously betting their minds and souls that they are worth the $1,000,000 bet. As for me, my tongue is in my cheek and I am wondering what will be in tomorrow morning's mail.

Ford Car Has Nearly 3500 Welds

THE automobile, once assembled by means of bolts and nuts, rivets, nails and solder, is today largely a product of the welder. This applies especially to the Ford V-8, which on a recent check disclosed 3415 welds, with the number steadily increasing.

In making such an extensive use of welding, the Ford Motor Co. has been obliged to design and build many of its own welding machines because for many of the operations there were no suitable machines available. Of the 3415 welds on a Ford V-8 Tudor sedan, 3154 were electric spot welds, 217 were electric arc or oxy-acetylene, and 44 were electric butt welds.

In the Rouge plant 5000 welding operations are carried on, five standard types of welding are used, and the equipment includes more than 1000 welding torches and over 600 welding machines. Most of the machines are automatic, controlled by synchronous tube timers.

Welding Automobile Doors

A new operation which has just been undertaken is the welding of the outer panel of the automobile door to the door frame, to check movement and squeaking. Thirty-two spot welds make the panel and frame a single immovable unit, and the operation is performed by a Ford-built automatic machine. The door is placed in the machine, a button is pressed, a slide moves the door down into working position, then in a series of machine movements the 32 spots are welded, eight at a time. There are eight transformers in this machine, hung at the top of the machine instead of below it, as is usual.

Most of the welding machines are in the pressed steel building, but each of the five tool and die departments has its own welding division. The trade school has its own welding department.

One of the most interesting welding operations in the pressed steel building is on the gasoline tank of the car. These were lockseamed and soldered in earlier days. About seven years ago Ford developed a method of seam-welding. The tanks are made in two halves, which are faced together and the edges welded down one side, across the end, back up the other side and across the other end. The tank welding machines are now being equipped each with a traveling carrier, which moves the tank to the various positions on the welding machine. The carrier operates on a low, flat-topped metal table and is moved by gears and chains while the welder runs the 102-in. seam in 90 sec. There are 11 welded spots to the inch, making a watertight seam.

The front end of the body, which used to be largely riveted, is now entirely welded. The ventilator, pillars and lower panels are assembled to the windshield, upper header section and cowl section by spot and arc welding.

There are about 50 welding operations on a single door. The door frame's three sections are flash-welded together by four machines, each with a capacity of 300 per hour. Even the lock is welded to the door.

Weld 72-In. Seam in 7 Sec.

One of the most spectacular operations is the welding of the rear body assembly. The rear panel and two quarter-panels are placed together in a large "balloon" flash-welding machine, the operator pushes a button, the machine closes, and in a shower of sparks two 72-in. seams are welded in 7 sec. The four machines were designed and built by Ford, and are said to be the largest welding machines ever made. The machines they displaced welded a 56-in. seam.

A difficult welding operation successfully used by Ford is in attaching the rear radius rod bracket to the rear axle housing. For this 12 double-head fully automatic arc welding machines are used, welding at a speed of 55 in. a minute. This weld leaves no skips at all. Few operators have succeeded in using the double-head arc in this way, and success has been achieved by eliminating the human element entirely. The time, pressure, power, quantity of wire, melting rate and other details are predetermined and automatic in these machines.

Rear Radius Rod Welded

Until 1935 only the front radius rod of the Ford was welded. The rear rod was a formed tube, the ends of which were flattened and bolted into place. It was decided to weld the rear rod of the 1935 car to provide greater strength. This ran up the cost; so manufacturers of welding equipment and supplies were called on for better products to reduce the cost, and the Ford welding department went to work with them on the problem. Better generators and welding heads and faster-melting wire were produced, and the problem was solved.

The driveshaft of the car, which used to be a solid and necessarily heavy member, is now a tube, reducing the weight without losing strength. The shaft is arc-welded, the driving end being welded to the tube. This is an entirely automatic operation.

Oxy-acetylene welding is extensively used in the Rouge plant, but mostly on maintenance work. It is used notably for cutting out dies from plates up to 10 in. thick, and from forgings sometimes 2 ft. thick. In production this type of welding is used chiefly for "tacking" operations on the body, especially in places which are hard to get at.

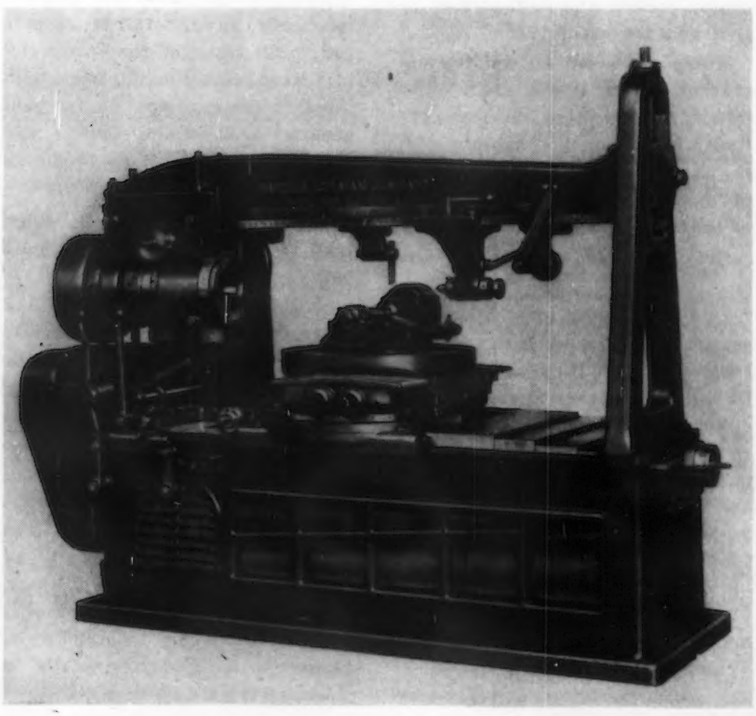
Hobbing Machine for Producing Taper Splines

A TAPER spline hobbing machine, designated as the type T, was among the exhibits of the Barber-Colman Co., Rockford, Ill., at the Machine Tool Show.

There are two general types of taper splines, one having tapering keys on a cylindrical center portion, the other having keys with parallel sides machined on the end of a straight shaft by cutting away the metal between the keys to form a taper. Both of these types are readily produced on these machines by using suitable hobs. While the hub or mating part for the type first mentioned does not lend itself as readily to rapid, economical production, machining of the hub to mate with the parallel-sided keys is easily accomplished by reaming a tapered hole in the piece and broaching the keyways.

Arrangement of the type T machine may be seen in the accompanying illustration. A heavy and well-ribbed base provides rigid support for the operating members, and also houses motor, main drive, coolant pump, and coolant reservoir. Change gears for speed, index, feed, and differential are entirely inclosed. Squared shaft, protected by sleeve, provides means for operating hob slide manually when desired. Work spindle is driven by accurate one-piece worm gear, meshing with hardened and ground worm. Full reading dial determines exact height of work above hob spindle and provides for accurate duplication of the work.

A heavy heat-treated and ground work-spindle, accurately mounted in adjustable double opposed tapered bronze bearings, has large hole all the way through; with a taper at the nose for receiving sleeves, arbors, collets, bushings, etc. Tapped holes are provided in spindle nose so that larger arbors, chucks, and heavier types of work-holding heads can be attached. Spindle extends through worm gear and the outer end is threaded for mounting air cylinders.



An adjustable work stop has an indicator scale for showing exact distance between spindle nose and stop finger, thus providing means for duplicating work position and assuring quick set-up. A full reading dial covers the whole length of adjustment and shows inches and thousandths between spindle nose and center line of hob carriage unit. Widely spaced graduations provide extremely accurate means for setting angle of hob slide ways.

The hob spindle is mounted in well-supported adjustable tapered bronze bearings. Outboard bearing is carried in a cradle which provides rigid support. Adjustable stops govern rapid approach of hob to work, feed, and quick return. Permanent safety limit and positive pin stops are provided.

An automatic power-driven lubricator supplies oil at regular intervals to bearings; the amount of oil supplied is adjustable, as is the interval between oilings. The entire system can be flushed any time by depressing a button. Anti-friction bearings are used at all important points on the machine with the exception of the work and hob spindle bearings, which are high-grade bronze. Taper splines are employed.

Specifications, in part, are: center distance between work and hob spindle, 1 in. minimum and 8¾ in. maximum; angular range of hob swivel, 360 deg.; angular range of hob swivel slide and ways, 15 deg. left to 195 deg. right from zero; travel of hob slide, 12 in.; face of work spindle to center line of hob swivel, 8 in. minimum and 42 in. maximum; maximum diameter of hob, 5 in.; hob speeds (8), 60 to 240 r.p.m.; range of feeds, per revolution of work, 0.010 in. to 0.250 in.; main drive shaft speed, 400 r.p.m.; and motor recommended, 5 hp. at 1150 r.p.m.

and Shop Equipment . . .

Automatic Indexing Drilling Machine With Increased Weight and Ranges

INCREASED weight and wider range of capacity in feeds and speeds are among the betterments provided in an improved No. 5 Millholland automatic indexing drilling machine, manufactured by Millholland Sales & Machine Co., Indianapolis. The index table speed has been stepped up to 720 indexes per hour. Even numbers of spindles from four to 12 or more can be assembled in the vertical drilling unit. The two horizontal units can be equipped with multiple spindle drill heads as required. The vertical unit employs a 7½-hp. motor; 3-hp. motors are used on the horizontal units.

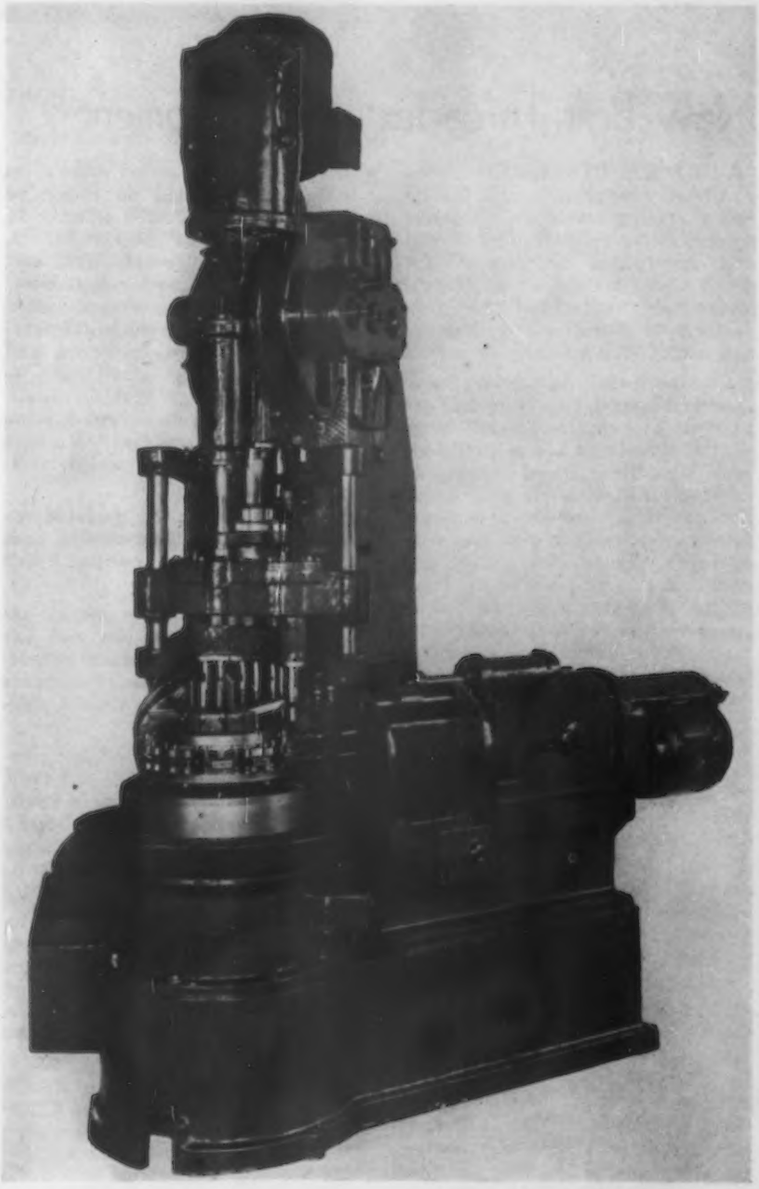
The type of machine base is determined by whether or not horizontal units are to be included in the machine equipment. The machine is sufficiently sensitive to drill ⅛-in. holes in steel, and is powered to handle 2½-in. bores and facing operations up to 3 in. in diameter.

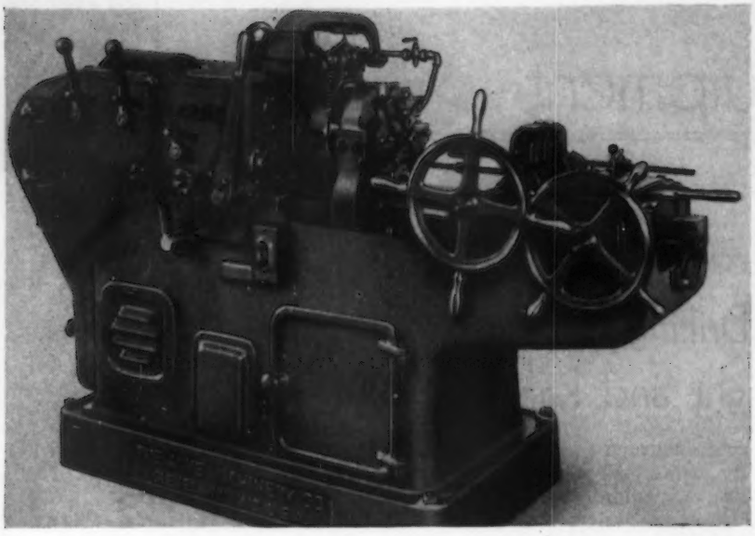
A standard No. 5, Millholland automatic drilling unit is used in the vertical position as a master unit for all feeds, both vertical and horizontal as well as for automatic indexing. An underneath burring attachment, for holes drilled vertically through work, is featured.

An 18-in. diameter table provides mounting for a number of compact holding fixtures which are available for multiple operations on a wide variety of work. Seventy per cent of machine-cycle time is said to be employed in material cutting. Special attention has been given convenience in work-handling under conditions of fast indexing.

Overload clutch provision throws out the entire feeding and indexing mechanism, without interfering with machine timing, and sets up an alarm in the event of broken or sticking tools.

Chip removal is accomplished through an arrangement of paddle wheels on the indexing table. These continually push chips into a gravity chute, through a down-spout into a strainer basket within the coolant sump-box. The coolant system is independently operated by a separate motor.





New Bolt Threader and Equipment

ACME MACHINERY CO., Cleveland, announces a new No. 35 bolt threading machine. Cleanline design, motor drive through V-belt and handwheel adjustment for depth of cut are featured. Control levers are centralized for convenience in operation. Adjustments are made with machine in action.

Chrome nickel steel gears, hardened and lapped, run in oil and are carried on chrome nickel steel shafts. Mountings are on preloaded bearings. Eight speed changes in substantially geometric progression are provided through a self-contained selective-type gear box with operating levers at front of machine. An index plate on the front of the headstock indicates proper speed position for each lever. Automatic flood lubrication is used in the headstock. Sight gage indicates oil level.

The machine can be furnished with either the Acme tangent die head or the Acme hobbed die head. Tangent type is suited to production work, while the hobbed type is more adapted to short runs. The die head is positioned close to the main spindle bearing for avoidance of overhang, and is cam-tripped at the end of the cut by a carriage movement. Lever hand trip is also provided. Small reservoirs on each end of the carriage provide constant lubrication of the ways. Either lever or handwheel may be had for carriage feed; telescopic guards are attached to protect ways from chips and dirt. For accurate lead and for heavy coarse-pitch threads, a specially designed leadscrew with rounded contour on threads is mounted on preloaded bearings and is located directly on the center line of the spindle. A tubular cover prevents dirt and chips from reaching the leadscrew. Removal of carriage cover gives access to reservoirs used in lubricating carriage ways, leadscrew and leadscrew nuts. A small knob on top of the cariage provides disengagement of the leadscrew. A pitch indicator is furnished. Various pitches are obtained through pick-off gears.

Driving motor is mounted on hinged plate in the machine base with single pulley multiple V-belt drive to main drive.

The vise is gibbed to provide adjustment on cross slide, and has both vertical and horizontal adjustment for maintaining accurate alinement with center line of spindle.

The coolant pump is of low pressure, automatically reversible type, driven direct from the main shaft. It has large capacity and is easily reached through sliding door in the base.

The bed is a one-piece semi-steel casting of box construction, heavily ribbed. The chips and coolant drop on to a screen, from which coolant drips into a settling chamber and then overflows to the reservoir, from which it is pumped to the work.

The tangent die head is furnished as standard equipment for production work up to 2 in. in diameter. It has only two main parts—the die ring and barrel.

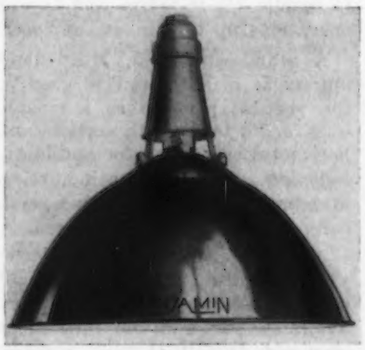
Adjustment shown in the accompanying illustration for controlling diameters can be made through handwheel without stopping machine. On coarse-pitch threads where two or more cuts are required, the adjustments for the various diameters can also be made without stopping the machine. A graduated scale at the top indicates exact position of dies. Two handwheels are furnished on machines equipped with leadscrew attachment; one adjusts for correct diameter of cut, and the other is used for adjustment during rougher cuts.

The leadscrew spindle is driven directly from the main spindle through the medium of two gear wheels. The bronze split nut which engages the leadscrew has its seat in the carriage and is operated by a convenient cam and lever.

The motion of the screw is reversed by moving the slide located in the headstock, that the right-hand gears are disengaged, and the left-hand gears engage the driving gear on the main spindle.

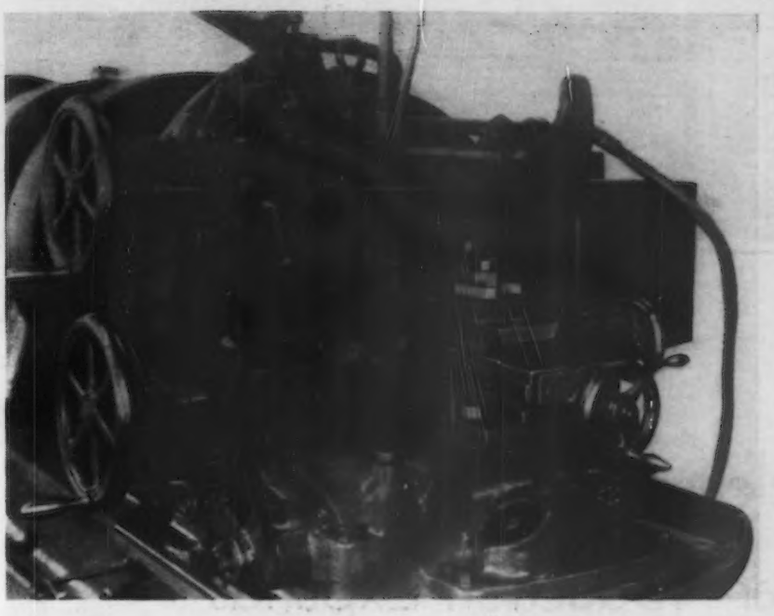
Interior Illumination By Mercury Vapor Lamp

MERCURY vapor lamp fixtures for general interior lighting are being marketed by Benjamin Electric Mfg. Co., Des Plaines, Ill.



Aluminum reflectors of both concentrating and spread types may be had. Porcelain enameled steel, dome-shaped reflectors for a broader distribution and coverage of both horizontal and vertical services are also available. Each type uses a standard 400-watt, high-intensity mercury vapor lamp.

Attachment is by either socket reflector or patented turnlox device which permits removal of lamp and reflector as a unit.



Pipe-threading and Machining Attachment

FOR the purpose of combining several machining operations with the cutting of Whitworth threads, the Landis Machine Co., Waynesboro, Pa., has introduced a facing and beveling attachment for its pipe-threading and cutting machines. The equipment is particularly adapted for the new-type screwed joint now used with heavy wall piping in connection with high-pressure and severe temperature change installations. The illustration shows a close-up of the cross-rail with the attachment in operating position. Adjustable cutting tools are employed and the attachment is universally adjustable within the range on the machine. The lead-screw provides positive feed. Primary advantage is said to lie in the fact that all operations are completed at one chucking.

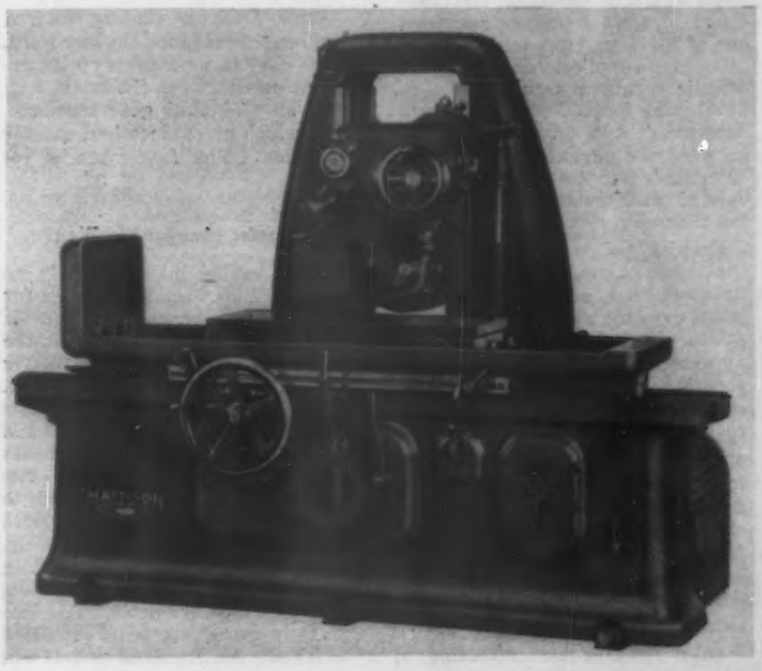
Improved High Power Surface Grinders

REFINEMENT of design characterizes the new Mattison Machine Works, Rockford, Ill., high power surface grinders, now built in five sizes, from 12 to 24 in.

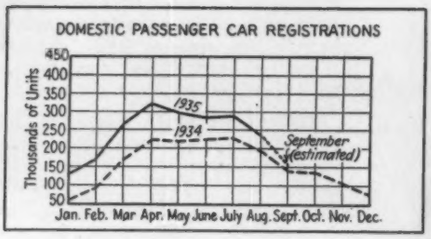
Typical of the new specifications are those given for the 16-in. surface grinder, which is here illustrated. Working surface is 16 in. wide by 6 ft., 7 ft., 8 ft., 10 ft., or 12 ft. long. The wheel-head adjusts vertically to allow 17 in. between table surface and a 14-in. wheel. The hydraulic table operates at speeds of 30 to 90 ft. per min. Table ways are automatically lubricated under forced feed.

Up and down traverse is power operated and the micrometer grinding index is graduated to 0.0001 in. Wheel cross-feed is under hydraulic or hand control, the total traverse being 11 in. to cover 16 in. grinding surface with 6-in. face wheel. Feeds are ⅛ in. to 2 in. at each reversal of the table. The spindle speed is 1150 r.p.m. and a 14-in. wheel has a peripheral speed of 4200 ft. per min. The alloy steel wheel spindle is heat-treated and ground, and can be supplied with either adjustable tapered bronze bearings or ball bearings. Rotating shafts are mounted on ball bearings, splash lubricated.

Motors are of the inclosed, fan-cooled, line start type. Full overload and under-voltage protection is provided. The built-in spindle motor is rated at 25 hp., 220, 440 or 550 volts, at 60, 40 or 25 cycles. The hydraulic, coolant and lubricating pumps are driven by a 7½-hp. ball bearing motor. Floor space of the 6-ft. machine is 6 ft. by 18 ft. 6 in., and that of the 12-ft. machine is 6 ft. by 30 ft. 6 in.



PERFORMANCE data on 55 applications of Carboloy cemented-carbide tools at the Machine Tool Show, held recently at Cleveland, are given in a 20-page booklet, designated as the A-10, published by the Carboloy Co., 2985 East Jefferson Avenue, Detroit. The 55 applications cover a variety of new machines, including lathes of engine, manufacturing and turret type; screw machines; millers, precision boring machines; horizontal boring, drilling and milling machines; boring mills; and a new "two-direction" planer. Data are given also on use of Carboloy diamond impregnated wheel dressers on grinding machines. Materials cut include cast iron, steel, brass, bronze and aluminum alloys. Close-up illustrations of tools and work are shown in connection with 46 of the applications listed. In all cases operations, speeds, feeds and cut are specified, and on production jobs, which predominate, floor to floor time is given.



THIS WEEK ON THE A

Steel Releases Grow in Volume As Car Production Expands

DETROIT, Oct. 8.

DYNAMIC Detroiters take their champion Tigers as seriously as they do their chief industry —the manufacture of motor cars. Hence normal activities the past week, despite the imminence of the New York automobile show and the start of a new production season, were seriously disrupted while automotive executives either cheered on Mickey Cochrane and his gang at the ball park or huddled around radios listening to the play-by-play description of the World Series.

During game time Detroit streets were literally deserted and corridors of office buildings reminded one of Sunday. After several futile attempts, suppliers abandoned in despair trying to talk business to purchasing agents. In one case a substantial steel tonnage hung fire all week, the purchasing official not being able "to find time" to take care of the Herculean task of placing the order.

Despite the week's distraction, the industry managed to push up its assemblies, and within another seven days the daily volume should attain a respectable total. It now appears that output in October should be well over 200,000 units, the exact figure depending on how fast companies can snap into full operations. Although the start of production on the part of two or three important makers has been slow, there is no reason to deviate from the earlier prediction that assemblies during the fourth quarter will range from 700,000 to 750,000 cars and trucks.

Steel releases are increasing in volume, with fairly good tonnages coming from Fisher Body as well as other General Motors divisions. Ford is expected after Oct. 15 to make its first steel buy since July. It is understood that Ford has met with delays in the building of 1936 models because of trouble in getting enough radiator shells and grilles, which are now stamped integrally. It is said that Dearborn recently has acquired an additional source of supply for this part, thus indicating that production wrinkles will be ironed out shortly. Ford is reported to have accumulated large stocks of most parts at branch assembly plants.

Aside from a slightly altered front-end appearance, the new Ford, which may be announced on Saturday or on Oct. 19 at the latest, will have an all-helical gear transmission, which gives smoother, quieter operation. The fabric top is retained.

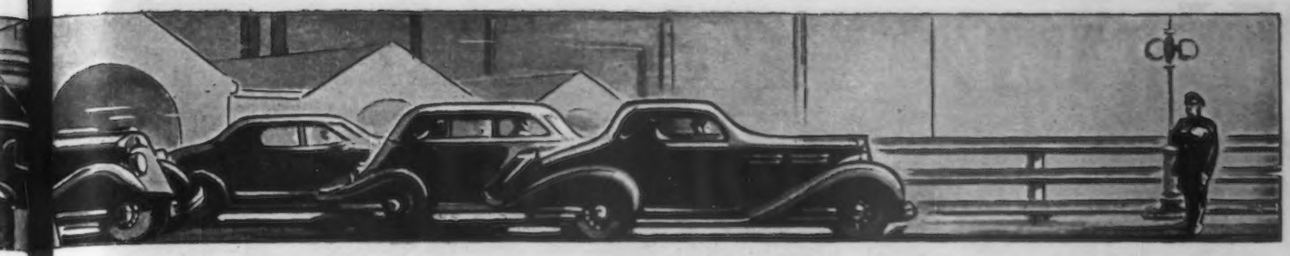
Chevrolet Standard Is Bigger

After having made virtually no changes in its Standard models for the last two years, Chevrolet is proceeding on the theory that the public wants a bigger and better car rather than a "stripped" job. The Standard will have the same engine as the Master in 1936 and also will feature hydraulic brakes and the solid steel turret top. The wheelbase has been increased to 109 in. and the overall length is 13 in. greater. The car is 135 lb. heavier, with bigger bodies which give more leg room and head room and permit wider seats. The line of body types has been expanded to seven. All Standard models will have box girder type chassis frames and pressed steel spoke wheels. Springing is improved by the use of longer front and shorter rear springs which more nearly equalize frequencies and minimize pitching.

Instead of the usual divided front seat of two-door models of the Master Chevrolet series, a single seat extends the width of the car, thus allowing three passengers to ride comfortably. The back of the seat is divided so that the right section can be folded forward over the cushion to open a way to the rear seats.

Hudson-Terraplane, planning on building 25,000 cars during the fourth quarter, is featuring so-called "radial safety control" on all its cars the coming year. It is claimed that this new system of front-end design, similar to that on Sir Malcolm Campbell's Bluebird, is now being used for the first time on a stock passenger car. With it the movements of the front axle are controlled by drop-forged torque arms. These arms (or rods), one on each side of the frame, are fixed to the side rails. Their action permits the front axle to rise and fall freely in the vertical plane and to deviate sufficiently from the horizontal position to accommodate the inequalities encountered on the road surface.

A husky lubricated vertical pivot pin at the front end of the torque rods, located in the front axle, and a rubber-bushed pivot bearing on the side rail at the rear end of the torque rods, give the slight transverse movement of the front axle due to thrusts from the wheels. Rubber bushings in the pivot bear-



ASSEMBLY LINE

BY BURNHAM FINNEY
Detroit Editor, The Iron Age

o o o

ings at the rear ends of the torque rods insulate the frame and body from road shock and maintain accurate control over the action of the front axle.

Introduction of the torque rods removes from the springs the work of driving the front axle and of absorbing brake torque. Front springs thus are designed primarily for suspension and are mounted on the axle by means of lubricated saddle bearings which fit around a cylindrical machined portion of the front axle. With this system of mounting, the front axle, with the torque rods, acts as a compound torque stabilizer rigidly resisting twist.

Hudson Has Draft Eliminator

The new "radial safety control" results in what Hudson's high-flown sales promotion literature describes as the "Rhythmic Ride" and "Tru-Line Steering." Hudsons and Terraplanes also have hydraulic brakes backed up by an emergency mechanical system. They also have automatic draft elimination. As air is withdrawn from the car by vacuum, instead of replacing the air with that which enters the body through leakage at miscellaneous points, all of the incoming air must pass through the draft eliminator, which consists of a screening cloth resembling the bag of a vacuum cleaner. This cloth is located above the rear axle in the body floor.

Both Hudson and Terraplane assert that they have 20 per cent more body room than usually found in cars in their price classes. Sedan body seats are 50 in. wide in front and 49 in. in the rear. The new lines of cars have deeper one-piece fenders, new die-cast radiator grille, increased curvature of the new one-piece roof (instead of the flange type formerly used), and increased slope at the rear. The electric hand and aluminum cylinder head (in place of cast iron) are optional equipment.

Pontiac, it is understood, will hammer away at prospects with the argument that its car is built to last 100,000 miles. The silver streak, which distinguished Pontiac from other cars the past year, has been accentuated. Thirteen vertical chrome-plated bars form the center grille and extend from the bottom of the radiator to the base of the windshield. On either side of it are said to be other grilles with horizontal bars tapered to conform to the contour of the radiator shell. Front fenders are more deeply crowned, as are the rear fenders. Front fenders and radiator shell present a more unified appearance because the conventional alley between them is reported to be largely eliminated.

Pontiac Offers New Pistons

Pontiac pistons are said to be of nickel-iron and will be cast in the Pontiac foundry as soon as it is revamped. Temporarily they are being made in the Chevrolet foundry at Saginaw. Due to new design which makes possible the use of thinner walls, the new pistons, which will be tin plated, are lighter in weight than 1935 pistons. Skirts are shorter because of improved oiling and cooling. Connecting rods are considerably stronger, with no increase in reciprocating weight. This is accomplished by utilizing the weight saved by shortening the piston skirts.

It is understood that Chevrolet will have the same type of pistons as Pontiac. Like Buick and Oldsmobile, both Chevrolet and Pontiac originally were understood to have decided on a shift to aluminum pistons for 1936. When these new nickel-iron pistons were designed, however, the change to aluminum was abandoned in favor of the new development. Buick and Oldsmobile have gone ahead with aluminum pistons, although the former does not acknowledge that its pistons are aluminum, always referring to them as "Anolite."

The story is that when Ford was developing its cast alloy steel pistons made of metal evolved by the Ford metallurgical department at Rouge, Chevrolet got wind of what was going on and set to work on a similar project. The nickel-iron pistons to be used the coming year by both Chevrolet and Pontiac are the outcome of this work.

Pontiac May Build Axles

Pontiac, incidentally, is reported to be planning on manufacturing axles for its cars at Pontiac, if the General Motors high command approves a request which is said to have been made by Pontiac's management. Pontiac at one time made its own axles, but for several years has been buying them from the local Chevrolet gear and axle plant. It is said that a building is available for axle manufacture in the older group of Pontiac shops in the heart of the city of Pontiac. If Pontiac gets the "go ahead" on this proposal, a large equipment buying program will be in order.

Tool buying, in general, is not expected to be large until after dealers are stocked with cars and the automobile shows are out of the way. Production executives have their hands full getting in machinery now on order and smoothing out operating difficulties. Equipment builders, in some cases, are still being "ridden" by automobile companies demanding deliveries of badly-needed tools. The fault usually is with the buyer, however, who has delayed too long in placing orders. He has not yet discovered that this isn't 1932 and that there now are a few customers outside the automobile industry in the market.

The new Chevrolet plant at Saginaw, where transmissions will be built, is about completed, but no orders for new production equipment have been placed. This leads one to the belief that pos-

(CONTINUED ON PAGE 89)

WERE YOU THERE?

It's history now, but you will

You who saw the Show in Cleveland will recognize our booth with its huge reception space, the largest single exhibit in the hall. And beyond are the machines and tools which illustrate so well the progress made in six years. This was the "Headquarters of Accuracy".

You carried home many new ideas from this booth of ours, ideas that will improve your shop, and increase its production and earning power. You saw machines that will be profitable investments, and cutting tools that show long strides forward in their ability to remove metal. There were gages of every description, reducing inspection costs and facilitating assembly.

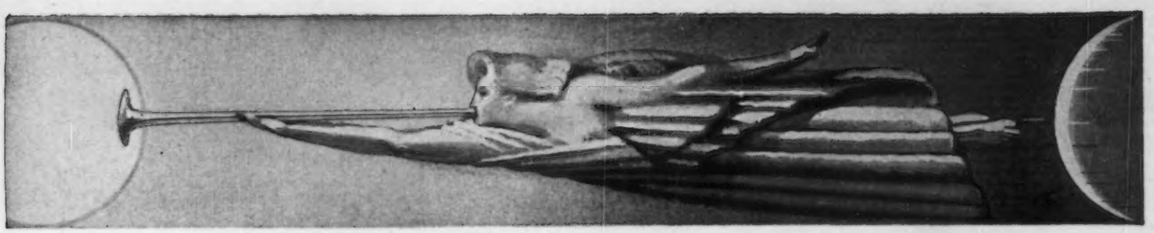
Now that the Show is over we would like to sit down quietly with you and apply

reap benefits from it for years!

the lessons of Cleveland to your problems. Ours is not a desire to unload machines on customers, but one of real assistance. You will find Pratt & Whitney sales engineers sincerely interested in your needs, and anxious to cooperate to the limit of their abilities.

Meanwhile, is there any of our literature which you failed to get in Cleveland which we can mail?

PRATT & WHITNEY CO.
HARTFORD, CONN.



NEWS OF THE WEEK

Nine Months' Steel Output 17 Per Cent Ahead of Corresponding 1934 Period

PRODUCTION of 2,829,835 gross tons of open-hearth and Bessemer steel ingots in September, announced today by the American Iron and Steel Institute, raised the nine months' total for 1935 to 24,044,076 gross tons. This production is 17 per cent higher than the total of 20,542,334 gross tons produced in the corresponding period of last year.

Average daily production of ingots during September was 113,193 gross tons, 4.7 per cent above the daily production in August of 108,123 gross tons, and 123 per cent above September, 1934. The daily production in September was the highest since February of this year.

The steel industry operated at 51.13 per cent of capacity in September, compared wi.h 48.84 per cent in August and 23.05 per cent in September a year ago.

REPORTED BY COMPANIES WHICH IN 1934 MADE 97.91 PER CENT OF THE OPEN-HEARTH AND 100 PER CENT OF THE BESSEMER INGOT PRODUCTION

	Reported Production (Gross Tons)		Calculated Monthly Production—All Companies		Number of Working Days	Per Cent of Operation
1934	Open-Hearth	Bessemer	Monthly	Daily		
January	1,786,458*	172,489	1,997,129†	73,968†	27	33.59†
February	1,993,465*	175,873	2,211,944†	92,164†	24	41.86†
March	2,540,243*	203,904	2,798,440†	103,646†	27	47.07†
April	2,622,531*	257,482	2,936,064†	117,443†	25	53.34†
May	3,003,676*	331,620	3,399,494†	125,907†	27	57.18†
June	2,718,782*	282,592	3,059,483†	117,672†	26	53.44†
July	1,340,924*	119,869	1,489,453†	59,578†	25	27.06†
August	1,245,139*	109,598	1,381,350†	51,161†	27	23.24†
September	1,127,269*	117,615*	1,268,977†	50,759†	25	23.05†
Nine months	18,378,487	1,771,042	20,542,334	88,165	233	40.04
October	1,325,777*	127,789	1,481,902†	54,885†	27	24.93†
November	1,447,626*	132,059	1,610,625†	61,947†	26	28.13†
December	1,794,437*	131,467*	1,964,257†	78,570†	25	35.68†
Total	22,946,327*	2,162,357*	25,599,118†	82,312†	311	37.38†
1935						
January	2,576,671	239,858	2,871,531*	106,353*	27	48.04*
February	2,500,062	224,336	2,777,765*	115,740*	24	52.28*
March	2,582,211	230,810	2,868,141*	110,313*	26	49.83*
April	2,358,249	231,916	2,640,504*	101,558*	26	45.87*
May	2,331,297	254,796	2,635,857*	97,624*	27	44.10*
June	1,978,180	210,487	2,230,893	89,236	25	40.31
July	2,003,011	224,456	2,270,224	87,316	26	39.44
August	1,629,828	223,361	2,919,326	108,123	27	48.84
September	2,541,840	238,737	2,829,835	113,193	25	51.13
Nine months	21,501,349	2,083,757	24,044,076	103,193	233	46.61

*Revised.
†Adjusted.

Philadelphia Foundry Group to Convene

THE first fall meeting of the recently organized Philadelphia chapter of the American Foundrymen's Association will be held at the Engineers Club, Philadelphia, on Friday evening, Oct. 11.

Sam Tour, vice-president, Lucius Pitkin, Inc., New York, will speak on "Profits and Losses in a Foundry"; Robert W. Phillips, manager of salvage and reclamation department, E. I. duPont deNemours, will talk on the "Romance of Waste."

W. B. Coleman, W. B. Coleman & Co., Philadelphia, is chairman of the chapter.

Drop Forging Shops Protest Billet Change

COST of making heavy drop forgings has been increased to such an extent by the advance in the price of forging billets and the placing of billets under 5 x 5 in. down to 4 x 4 in. on a bar base that forge shops cannot compete with steel foundries on a price basis for heavy industrial forgings and buyers now are substituting steel castings when they can be substituted,

according to the complaint of many forge shops.

In one specific case reported by a maker of forgings, the selling price of a 35-lb. heavy forging had to be advanced 27c. and the customer who had previously switched from a steel casting to a forging for this particular part has gone back to a steel casting, which he can purchase at about the same price as the price of the forging before the advance in raw material necessitated an advance in the price of forgings.

Taking cognizance of the situation that has developed in the forging industry the Drop Forging Association at a meeting a few days ago adopted a resolution declaring that the placing of 4 x 4 in. billets on a bar base is equivalent to a price advance of 47 per cent and will result in considerable loss to both the steel industry and drop forgers.

Wisconsin Steel to Modernize Plant

INTERNATIONAL HARVESTER CO. has authorized the immediate expenditure of $2,225,000 for enlarging and modernizing its Wisconsin Steel Co., South Chicago. The announcement was made by C. F. Biggert, vice-president in charge of steel mill and iron and coal mines. Of the sum to be expended, about $2,000,000 will go for modernization of the company's No. 2 merchant mill which will include electrification of that unit. About $250,000 will be expended for installation of a new turbo blower in the blast furnace department.

Increases Machine Tool Quotas

WASHINGTON, Oct. 8.—The French import quota restrictions on certain machine tools were abolished and the import duties on these items were substantially increased instead, with revised classifications, by a decree published in the French *Journal Officiel* for Sept. 29, effective Oct. 1, according to a cablegram to the Department of Commerce from Commercial Attache H. C. MacLean, Paris. No further details of these duty increases are yet available.

The French import quotas for the fourth quarter of 1935 for certain other industrial products hitherto subject to import quota restriction were also published, without important changes, in the French *Journal Officiel* for Sept. 29.

Chicago Foundrymen Start Lecture Course

THE second annual lecture course sponsored by the Chicago chapter of the American Foundrymen's Association will open Oct. 14 at 7.30 p. m. at Lewis Institute, 1951 West Madison Street, Chicago. Fees are $1 for members, $2 for non-members, and single lectures are charged for at the rate of 50c. each.

Refractories in the foundry will be the subject on Oct. 14. Theoretical aspects of molding sand will be covered on Oct. 28, and fuels used in the foundry will be the subject on Nov. 4. On Nov. 11, scrap will be studied, and alloys are up for discussion Nov. 25. On Dec. 2 the discussion will center on customers' inspection of foundry products.

PERSONALS

JOHN D. SWAIN has been elected vice-president of Electro Metallurgical Sales Corpn., New York. He has been vice-president of the Linde Air Products Co. and Union Carbide Sales Co., which are other units of the Union Carbide & Carbon Corpn. He has been actively connected with these units for a period of 20 years.

❖ ❖ ❖

GEORGE G. THORP, who on Sept. 30 retired as president of the Illinois Steel Co., has moved to Madison, Wis., where he will make his home. He was born at Pittsburgh and took a course in mechanical engineering at the University of Wisconsin. When he completed the course in 1891 he decided to spend one year at the university in special research work before entering a business career.

In 1892 he accepted the position of engineer of tests at the old North works of Illinois Steel Co. This plant later was converted into a warehouse, but in 1892 it had the only Illinois Steel Co. capacity for structural shapes. From North works Mr. Thorp was transferred to Joliet works as assistant master mechanic, which position he left to become chief engineer for three years of the Colorado Fuel & Iron Co., Pueblo, Colo. Upon his return to the Illinois Steel Co., in 1899, he was made general superintendent of the Joliet works.

His next move was to Pittsburgh, where he spent five years up to 1906, first installing and then operating the Clairton works for Carnegie Steel Co. He was then recalled to Chicago to become vice-president of Illinois Steel Co., and also vice-president of the Indiana Steel Co., which undertook the task of building the Gary works at the southern tip of Lake Michigan. From 1906 to 1932 Mr. Thorp directed his energy into both the design and operation of that development. It is one of the largest steel-making plants in the country. In 1932 Mr. Thorp was made president of Illinois Steel Co., succeeding EUGENE J. BUFFINGTON.

❖ ❖ ❖

WALTHER MATHESIUS was appointed, effective Oct. 1, manager of operations in the Chicago district for the Carnegie-Illinois Steel Corpn. Mr. Mathesius was born in Berlin, Germany, and was graduated in 1911 from the Institute of Technology of that city. His first work in this country was at the Worcester plant of the American Steel & Wire Co. In 1912 he entered the blast furnace department of South works, Illinois Steel Co.

JOHN D. SWAIN

In 1917 he was made superintendent of that department and in 1925 he was promoted to assistant general superintendent. He was made general superintendent of South works in the early part of 1935, this being the position he held at the time of his promotion to manager of operations for the Chicago district.

E. E. MOORE has been named general superintendent of South works, succeeding Mr. Mathesius. Mr. Moore made his start at the Gary tin mills in 1919 and in 1925 he was appointed assistant manager of the Shenango works, American Sheet & Tin Plate Co. He returned to the Gary tin mills in 1927 as assistant manager and in 1932 he was made assistant to the vice-president, Illinois Steel Co.

The following additional appointments in the Carnegie-Illinois Steel Corpn. were made effective on Oct. 1: WILLIAM C. OBERG, manager of operations Pittsburgh district; SYDNEY DILLON, chief engineer; C. F. W. RYS, chief metallurgical engineer; JOHN A. HAGAN, chief industrial engineer; R. B. PORTER, manager of operations Lorain division; CHARLES B. GETSINGER, director of fuel and power; FRED E. KLING, chief engineer Pittsburgh district; EDWARD T. BARRON, manager metallurgical department Pittsburgh district, and JOHN BRUNNER, manager metallurgical department Chicago district.

❖ ❖ ❖

DAVID E. JENKINS has been appointed assistant to BENJAMIN F. FAIRLESS, president Carnegie-Illinois Steel Corpn., Pittsburgh. Mr. Jenkins has been identified with the steel industry for about 27 years. He went with the American Sheet & Tin Plate Co. in 1908, and in 1917 he became associated with Timken Roller Bearing Co., Canton, Ohio. In 1924 he joined United Alloy Steel Corpn., remaining with that organization until it merged with Central Steel Co. at Massillon to form Central Alloy Steel Corpn. He stayed at Massillon until the formation of the Republic Steel Corpn. in 1930, when he went to Youngstown as assistant to Mr. Fairless, who then was first vice-president of the Republic organization.

❖ ❖ ❖

JAMES J. GARVEY has been appointed secretary to Mr. Fairless at Pittsburgh. Mr. Garvey was transferred from the United States Steel Corpn. offices at New York, where he had been employed since 1918. During his career there he was engaged in secretarial duties with W. R. WALKER, I. LAMONT HUGHES, AMBROSE N. DIEHL, and became assistant secretary to W. A. IRVIN.

❖ ❖ ❖

R. H. CLARKE, formerly vice-president of Otis Steel Co., and Midland Steel Products Co., Cleveland, has been elected chairman of the board of the Apex Electrical Mfg. Co., Cleveland. Mr. Clarke, after resigning from the two Cleveland companies two or three years ago, went to California for his health and recently has been affiliated with one of the Apex plants in Oakland, Cal.

❖ ❖ ❖

J. H. VAN CAMPEN, special engineer for Republic Steel Corpn., has been appointed chief engineer of the Corrigan, McKinney division, with headquarters in Cleveland. A graduate of Pratt Institute with the degree of mechanical engineer, Mr. Van Campen was employed for a time as a structural iron worker and in 1911 joined the Bethlehem Steel Co. as engineer of its Soucon plant, where he remained for six years. From there he went to the Weirton Steel Co., Weirton, W. Va., as chief draftsman. He became assistant chief engineer of the Midvale Steel Co., Coatesville, Pa., in 1920, and after remaining there for five years became special development engineer for the Timken Roller Bearing Co., working particularly on large bearings for mills. Subsequently he became chief engineer of the E. W. Bliss Co. at Salem, Ohio, where he remained two years. This was followed by four years as chief engineer for the Youngstown and Warren districts of the Republic Steel Corpn., which he left to spend a year in Japan doing special work for the United Engineering & Foundry Co., and on his return became special engineer for Republic.

British Iron and Steel Markets Are Unaffected by War Crisis

LONDON, Oct. 7.—(*By Cable*)—British iron and steel activity is unaffected by the international crisis. Pig iron is firm though fresh buying is limited to small parcels as most consumers are well covered over next few months. Scottish specifications for foundry iron are heavier and Sheffield, Birmingham and Middlesbrough are the chief outlets for hematite.

Purchases of foreign semi-finished under the fourth quarter's quota are being resumed but pressure for deliveries of British material are unabated. Demand for structural steel is strong. Rail and plate mills are fairly busy. Several new shipbuilding orders have been placed, and naval orders pending promise heavy work for the steel industry.

Contraction in overseas trade is attributed to disturbed exchanges and the partial failure of the wheat crop.

Tin plate is active with output exceeding 58 per cent of capacity. The home trade is exceptionally good and exports are fair in several markets, including India.

Continental iron and steel buyers are limiting purchases to immediate needs owing to political tension. Far Eastern markets are affected by higher transport costs. Belgian works are more active following recent Russian orders and rolling stock orders from home railroads. The International Wire Rod Cartel is maintaining production program for the fourth quarter of 360,000 tons.

British Prices, f.o.b. United Kingdom Ports

Per Gross Ton

Ferromanganese, export	£9
Billets, open-hearth	£5 10s. to £5 15s.
Tin plate, per base box	*18s. 2d. to 18s. 7½d.*
Steel bars, open-hearth	£7 17½s.
Beams, open-hearth	£7 7½s.
Channels, open-hearth	£7 12½s.
Angles, open-hearth	£7 7½s.
Black sheets, No. 24 gage	£9 5s.
Galvanized sheets, No. 24 gage	£11 5s.

*To Jan. 1; 18s. 3d. to 18s. 10½d thereafter.

Official Continental Prices, f.o.b. Continental Ports

Per Metric Ton, Gold £

Current dollar equivalent is ascertained by multiplying gold pound price by 124.14 to obtain franc equivalent and then converting at present rate of dollar-franc exchange.

Billets, Thomas	£2 7s.
Wire rods, No. 5 B.W.G.	£4 10s.
Steel Bars, merchant	£3 5s.
Sheet bars	£2 8s.
Plate, ¼ in. and up	£4 2s. 6d.
Plate, 3/16 in. and 5 mm.	£4 4s. 3d.
Sheets, ⅛ in.	£4 9s. 3d.
Beams, Thomas	£3 2s. 6d.
Angles (Basic)	£3 2s. 6d.
Hoops and strip base	£4 2s. 6d.
Wire, plain, No. 8	£5 7s. 6d.
Wire nails	£5 15s.
Wire, barbed, 4 pt. No. 10 B.W.G.	£8 15s.

Republic Consolidates Detroit Sales Offices

DETROIT district sales offices of the Corrigan McKinney Steel Co. and the Newton Steel Co., both of which have recently been acquired by Republic Steel Corpn., have been consolidated with those of the Republic company on the twentieth floor of the Fisher Building under Arthur Schaeffer, Republic's district sales manager at Detroit.

There is no change in the personnel, Whitford C. Gillies, formerly with Corrigan McKinney, continuing with Republic. Charles Poxson, who has had charge of Newton sales at Detroit, will continue in that capacity. The Newton Steel Co. will retain its corporate identity for the present in its sales at Detroit.

Republic Offices to Go to Cleveland

REPUBLIC STEEL CORPN. will move its general offices from Youngstown to Cleveland about Jan. 1, merging these offices with the company's executive offices now located in the Union Trust Building and the general offices of the Corrigan, McKinney Steel Co. The advertising department of Republic, now located in Massillon, will also be transferred to Cleveland. The move will result in the removal to Cleveland of 300 members of the Republic organization.

The Republic executives who will move to Cleveland include: R. J. Wysor, executive vice-president and general manager; N. J. Clarke, vice-president in charge of sales; C. M. White, vice-president in charge of operations; W. W. Hancock, secretary-treasurer, and P. F. Boyer, comptroller. Now located in Cleveland are T. M. Girdler, chairman, Myron A. Wick and Donald B. Gillies, vice-presidents, the latter formerly president of the Corrigan, McKinney company.

While the location of the enlarged executive offices has not been announced, many probably will be located in the Corrigan, McKinney office building, a modern structure in which considerable space is available.

Program for Steel Constructors Meet

AN interesting program has been arranged for the thirteenth annual convention of the American Institute of Steel Construction at the Greenbrier, White Sulphur Springs, W. Va., Oct. 16, 17 and 18.

Among the addresses planned are the following: "Possibilities from Cooperation," R. B. Thomas, attorney, New York; "What's Going On?" Alexander Wall, Robert Morris Associates, Lansdowne, Pa.; "Government's Aid to Housing," Albert C. Shire, chief engineer, Technical Division, Federal Housing Administration, Washington; "Steel Dams," Dr. O. E. Hovey, Consulting Engineer, New York; "Rigid Frame Bridge Tests," Prof. H. L. Whittemore, chief, engineering mechanics section, Bureau of Standards, Washington; "Control of Welding in the Fabricating Industry," Robert E. Kinkead, Consulting Engineer, Cleveland, and "Opportunities for Steel," E. L. Shaner, Editor, *Steel*, Cleveland.

The last day of the convention will be given over to a discussion of the bid depositary, cost estimating formula and other internal problems. It will be under the direct charge of Robert T. Brook, executive vice-president of the institute.

A plan for cooperative purchasing of oxygen was adopted at a meeting of the Boston chapter of the Institute of Scrap Iron and Steel, held Sept. 26 at the Parker House in Boston. It is proposed that the initial rate shall be $1, as against approximately $1.20, which is now being paid by the average dealer to various companies, with other savings proposed for the future. This is the second step undertaken by the Boston chapter to reduce costs of operations for its members. Recently, a group plan for compensation insurance was put into effect for the members with a substantial saving.

THIS WEEK IN WASHINGTON

President calls on private industry to help share relief burden, although not admitting breakdown of WPA.

o o o

New policy of using relief funds to finance strikes is announced by assistant secretary of labor.

o o o

New keeper of Blue Eagle lays plans for reviving the dead bird.

o o o

Secretary Wallace finds that "hot potatoes" are not so easy to drop.

o o o

Procedure for adoption of voluntary trade practice agreements is outlined at White House.

o o o

BY L. W. MOFFETT

Resident Washington Editor, The Iron Age

o o o

WASHINGTON, Oct. 8.—Private industry is being exhorted to share more liberally in the burden of relief. . . It must bridge the vast yawning gap of unemployment as the President airily declares that the Government has done its part toward starting the country on the road to recovery. . . . Yet the President concedes that the works-relief program "has moved more slowly than I had hoped." . . . There are millions who state it much more strongly. . . . They maintain that the WPA virtually has collapsed and in this category are some prominent Administration sympathizers. . .

Concern over the unemployment situation becomes more tense with the approach of Nov. 1, the deadline for taking 3,500,000 "employables" off the relief rolls. . . . That is to say to substitute boondoggling for the most part for direct undisguised doles. . . . The latter necessity, for necessity it has been under the circumstances, is viewed by critics as the sounder method, cheaper and more effective. . . . Boondoggling, however, gives the appearance of work and "cultural training" and perhaps politically it may find more general favor in the public mind. . . . Again it may not. . . . In any event the political phase is given important consideration as the Presidential campaign is now well under way. . . . The number of idle "employables" is being reduced at the rate of only 10,000 per week, according to reports. . . .

The "quick moving" projects, which the Administration has insisted upon, are moving about as slowly as the worth-while, permanent projects, ultimately to involve much larger employment in the heavy industries, for which Harold I. Ickes, Public Works Administrator, fought unsuccessfully with Harry L. Hopkins, Works Progress Administrator. . . . The latter has been allocated the enormous sum of $1,907,632,454, almost half of the total of the $4,000,000,000 works-relief fund. . . . After the Ickes-Hopkins row was settled by the President, the Public Works Administrator was given $327,000,000. . . . . And sounder than the boondoggling program though it is, the number put to work under the heavy project program has been painfully small. . . . It is estimated at not much more than 500 on non-Federal projects and some 50,000 on Federal projects. . . . The instances in both cases reflect the failure of huge Government spending to bring about prosperity and to take up unemployment. . . . Since, however, there is a determination to indulge in spending, it is clear it could be best directed toward permanent work, with demand for labor and materials going chiefly to the heavy industries where the greatest unemployment exists. . . . But the drastic shaving down in this direction is plainly shown by a few examples. . . . Of the $400,000,000 which had been proposed for grade-crossing elimination and road construction, only $13,762,000 has been given Presidential approval, a mere 4 per cent of the total originally earmarked for these purposes. . . . At least, it was supposed to have been so earmarked. . . . Other major programs have also gone by the wayside, and even where permanent construction work has been determined it has been delayed by rows. . . .

Private Industry Holds Key

This situation probably explains the reason for turning to private

industry, which so often in the past has been the object of the wrath coming from Administration sources for opposing legislation that has hindered it. . . . It had been even proposed that industry be taxed on gifts for relief which it is now being urged to share in more fully. . . . Private industry obviously is just as anxious as the Administration can be to take up the slack in unemployment for that means further progress toward recovery with a shift from the red to the black, and from the humane point of view it means relief for the distressed. . . . And it may be added that private industry has done a great deal more in the latter direction than officialdom seems ready to credit it with. . . .

Recovery is under way and it is sincerely hoped that it will continue consistently and soundly; for manifestly in it lies the only hope of absorbing the unemployed. . . . This will never be done if dependence is to be placed upon the Government with its makeshift, tremendously costly and ineffectual expedients which are piling up a huge national debt that inevitably means higher and higher taxation for present and future generations. . . . . Attempts to give a rosy picture to the treasury situation are pathetically futile. . . . So, too, is the attempt to credit the Government with starting the country toward recovery. . . . Official Washington resents it, but nevertheless there is a well fixed idea that recovery is being made not on account of but rather in spite of what the Government has done. . . .

Labor Takes Advantage of Relief Funds

And while private industry is being appealed to pull the Government out of the WPA mess and to put the idle to work, private industry sees itself faced with WPA funds as a club to compel it to knuckle to the demands of organized labor. . . . For what other interpretation is to be placed on the tactics used to force coal operators to bow to the United Mine Workers in settling the coal strike? . . . As the long-drawn-out controversy over wage and hour contracts finally settled down to a point where the only difference remaining centered about the matter of 1½c. per hr., Edward F. McGrady, assistant secretary of labor, and an official of the American Federation of Labor, drew out the WPA as the ace in the hole. . . . He found it the most effective weapon that had fallen into his hands as negotiator. . . . . Rising before the deadlocked meeting, he is reported to have told the coal operators in no uncertain terms that they could not win the strike. . . . Time was, so he is said to have informed the operators, when miners who quit work, had credit cut off at company stores and they and their families faced starvation after a few weeks, breaking down morale and forcing them to return to the mines. . . . But he assured the coal operators that that would not "happen this time." . . . The astonished operators were then told why. . . . Because, said Mr. McGrady, every woman and child would be fed by the Government . . . Hence, he informed them, the "old strike breaking methods won't work." . . .

It developed that Mr. McGrady was not bluffing. . . . He was stating facts . . . . He had been assured by Mr. Hopkins that FERA would aid the striking miners and their families. . . . President John L. Lewis of the United Mine Workers also evidently had this assurance for he boomed forth: "Certainly our people expect relief from the various agencies of the Government. They do not intend to starve and they do not expect the country to starve them or to permit the operators to do so." . . .

It did not appear to be the merits of the case that determined its settlement. . . . It was the promised use of Government funds as a blackjack. . . . . It was in short an invitation to strike, a proferred subsidy to strike, an amazing precedent that may well point the way to further strikes . . . The move was supposed to be smart. . . . Even aside from the means used, or the right of the mighty Hopkins to spend $2,000,000,000 of public money as he sees fit, the "smartness" of the move may well be challenged. . . . Would it be politically or otherwise smart to add 450,000 to the already staggering list of unemployed, to halt the coal mining industry and industries dependent upon it? . . . If it is smart, why not give a twist of dignity and formality to the situation and hereafter send out embossed invitations to strike? . . . And that incidentally would be a contribution to the boondoggling industry. . . . The President called the settlement "splendid example of collective bargaining." . . . Splendid for whom? . . .

Meanwhile, the Government has filed answers to court attacks on the Guffey-Snyder coal act. . . . One in the Supreme Court of the District of Columbia and the other in the United States District Court for the Western District of Kentucky at Louisville. . . . The former court recently denied an injunction against operation of the act asked by President James Walter of the Carter Coal Co., through Attorney Frederick H. Wood. . . . Judge O'Donoghue upheld the Government's contention that the claim of injury from the act was premature because the law has not yet gone into effect. . . . Western Kentucky operators challenged the constitutionality of the act, as did Mr. Carter. . . . The next move in the Carter case will be a court hearing on Mr. Carter's petition for a permanent injunction. . . . The Department of Justice in its answers not only upholds the constitutionality of the act, in the course of which it maintains the coal industry is a part of interstate commerce, but it proceeds to argue that regulation as proposed by the act is necessary to stabilization of the industry. . . . Attacks on the law by captive mines owned by steel companies have not as yet been made in court. . . .

Reviewing of the Blue Eagle

Efforts are being made to blow the breath of full pulsing life into the Blue Eagle, laid low by Mr. Wood's smashing arguments before the Supreme Court. . . . To this end Major George L. Berry, recently appointed NRA coordinator for industrial cooperation, has announced that he is preparing to call conferences of management and labor to determine "their attitude with regard to the development of some permanent procedure for establishing fair trade practice." . . . Thousands of letters will pour forth from NRA inviting industrial and labor leaders to the conferences, following which Major Berry will make a report to the President. . . .

This move is taken to signify a move for NRA legislation at the next session of Congress, perhaps along the lines asked by the President in his message to Congress on the eve of its recent adjournment. . . . Since then, however, adding to the confusion faced by the Blue Eagle since its birth, the President has said no legislation would be necessary if industry adopts fair trade practices and stops chiseling. . . . Declaring that he is moving "as fast as the Lord will let me," Major Berry says he is trying to bring management and labor together. . . . This implies high hope that the response from industry to his invitations will be favorable and that the Blue Eagle once more will be perched as a powerful "guardian" over industry. . . . It shows also that the Major has no great confidence in the existing NIRA providing only for voluntary agreements under the supervision of the Federal Trade Commission, with NRA given authority to pass only upon labor provisions. . . .

Senator King, Democrat, of Utah, doesn't share the enthusiasm that Major Berry does over the Blue

Eagle, and Major Berry says there are differing views among industrialists. . . . It was not stated but it is well known that NRA officials are extremely skeptical that some of the major industries, including the steel and automotive, will show the least interest in the move to revive the Blue Eagle. . . . Senator King is boiling because the skeletonized NRA is not torn apart at once and its bones buried. . . . He has threatened a Congressional investigation because NRA is not speeding up the reduction of its staff, which on Sept. 7 still numbered 2760 with salaries totaling $7,023,220. . . .

Informed by L. J. Martin, acting NRA Administrator, that the force is being reduced at the rate of 75 a week, the Utah Senator said that unless the reductions are speeded he probably will call the facts to the attention of Congress at the next session and recommend that NRA dismiss its big force. . . . "Why, they've still got hundreds of lawyers down there doing nothing but twiddling their thumbs," sniffed the Senator. "They are being kept busy writing reports on old codes. That stuff ought to be thrown into the waste basket." . . .

▼ ▼ ▼

Potatoes Still "Hot"

Agricultural regimentation is not all cotton, peanuts and 6,410,866 slaughtered piggies and sows. . . . There are potatoes, real hot spuds. . . . Secretary of Agriculture Wallace, prize farm regimenter, found this out last week when he faced a group of belligerent potato growers led by Senator Josiah W Bailey and Representative Lindsay Warren, of North Carolina, roaring "nullification" and "AAA rebellion" in answer to the Secretary's statement made the previous day that the potato control law is not going to be enforced. . . . The cry of "nullification" was raised by Representative Warren, said to be the real author of the potato control act, which was tacked onto the AAA much to the disgust of the Secretary of Agriculture. . . .

Senator Bailey and Representative Warren heatedly shouted to AAA that the potato control act would not be nullified. . . . They refused to accept the excuse that there were no funds for administration of the act nor were they impressed by Mr. Wallace's statement that "I do not think you can enforce laws in this country that go against the majority." . . . Even then he said he could not see how it could be done without wide bootlegging. . . . Nor did the impassioned potato growers enthuse over his suggestion for a potato referendum as he warned against "antagonizing the consumer or getting into the potato field." . . . Consumers kicked hard against the legislative absurdity. . . . Mr. Wallace at least knows now he started something he can't stop when he entered with self-assurance upon his program of farm regimentation. . . . Nor need the allusion be confined to farm regimentation. . . .

▼ ▼ ▼

ICC Turns Down Ore Pooling Plan

The Interstate Commerce Commission has denied the application of the Chicago & North Western, the Escanaba, Iron Mountain & Western and the Chicago, Milwaukee, St. Paul & Pacific railroads for authority to pool ore traffic from the Menominee range in Michigan and Wisconsin to the docks at Escanaba, Mich. The carriers had entered into a 99-yr. contract which provided for the pooling plan through the joint use of the North Western's tracks at Escanaba and a division of earnings on such traffic. The contract was made subject to ICC approval.

The commission assumed jurisdiction because the contract would mean abandonment by the Milwaukee of the use of the Escanaba tracks, which the Milwaukee leases, from Channing to Escanaba. It was pointed out by the commission that before the Milwaukee may abandon this operation it must procure from the commission a certificate of convenience and necessity. The Milwaukee's docks at Escanaba, the report said, have now deteriorated to such an extent that they are not now usable, and it is using the North Western's docks on the terms agreed to in the contract but that arrangement does not extend beyond the current year.

The pooling plan was proposed as a matter of economy. The carriers contended the shippers on the Menominee range and the public at Escanaba would receive the same service by the Milwaukee they have heretofore enjoyed and that the proposed joint operations would mean only a rerouting of the ore traffic between existing terminals over the rails of the North Western instead of over those of the Escanaba. Opposition to the plan was made by the Chamber of Commerce of Escanaba, Representative Frank E. Hook of Michigan and officials of the four railroad brotherhoods.

▼ ▼ ▼

Newport News Shipyard Awarded Cruiser Contract

The Newport News Shipbuilding & Dry Dock Co., Newport News, Va., the only bidder, was awarded the contract for the construction of a 10,000-ton light cruiser last Friday by the Navy Department. The price was $13,196,000, subject to adjustments for changes in costs of labor and materials. Delivery was promised for Jan. 2, 1939. The cruiser will require about 7000 tons of steel, consisting of approximately 4200 tons of plates, 2100 tons of shapes and 700 tons of bars.

The Navy Department will open bids, Oct. 22, on 850 tons of structural and bar shapes, about evenly divided between black and galvanized material, for seven destroyers to be built in navy yards. On Oct. 11 bids will be opened on 685 tons of black and galvanized medium shapes for the seven destroyers and a light cruiser. Dimensions of I-beams, according to the specifications, are to be "as per J. & L. Junior beams."

▼ ▼ ▼

ICC Approves New York Central Rail Purchase

The Interstate Commerce Commission has approved an application of the New York Central railroad for authority to negotiate a PWA loan to finance the purchase of 7400 tons of new rails and other track material, estimated to cost $386,000. Only 4900 tons of rails, with the necessary appurtenances, is to be laid at once in replacement of old rails, the remaining 2500 tons to be laid from time to time as required.

The application of the Gulf, Mobile & Northern railroad for ICC authority for a $300,000 PWA loan mentioned in THE IRON AGE of Oct. 3, in addition to calling for the purchase of rails also calls for the purchase of 600 kegs of spikes and 135,000 tie plates. The actual rail requirements will be 4333 tons.

▼ ▼ ▼

Trade Practice Agreement Procedure Outlined

The voluntary trade practice agreement program provided for the Federal Trade Commission in an executive order of Sept. 26 was detailed in a statement made public at the White House last week.

President Roosevelt gave authority to the FTC to negotiate agreements without labor provisions but pointed out that they could not be exempted, as they were under NRA codes, from the anti-trust laws. Labor provisions are to be referred to NRA. The latter will consider the labor provisions through a mechanism similar to that which it has used in the past, including a Labor Advisory unit and an In-

dustrial Advisory unit, set up in conference with the Department of Labor and the Department of Commerce respectively. After holding open hearings NRA will determine whether or not to recommend approval of the proposed labor provisions.

Upon making a decision NRA will return the provisions and recommendations to the FTC, together with a transcript of hearings and its findings.

Meanwhile the FTC will examine agreements and if properly drawn as to trade practices it will hold hearings. If it disapproves of the agreements it will make an order to that effect and in doing so refer to the executive order. If the commission shall favor approval of the trade practice agreements, it will transmit to the President the labor provisions and recommendations of NRA, if favorable, together with a statement as to the commission's approval of the other provisions, for Presidential action on the labor provisions. If Presidential approval is given, the commission will issue an order effectuating the trade practices. If the President notifies the commission of his disapproval of the labor provisions, industries proposing agreements will be at liberty to request the commission to consider such trade practice agreements under its trade practice conference procedure or to withdraw.

Technical steps of procedure are set forth in the statement.

▼ ▼ ▼

Shipments of Arms Enlarged

Following the Presidential proclamation of last Saturday declaring an embargo on shipments of "arms, munitions and implements of war" to Italy or Ethiopia, interest now is centered in the possibility that the list may be expanded to include iron and steel, copper, cotton and other products. It is obvious that it cannot be known what, if any, additions may be made to the list. Nor can it be known whether the embargo may be amplified not only as to products but as to countries. Necessarily the matter is dependent upon the developments in the war situation—whether it will be confined to Italy and Ethiopia or whether the war will be spread to include other nations.

It is the present hope, as well as belief, that the war will be confined to Ethiopia and that additional products will not be included in the embargo list. On the other hand the very nature of the war exigencies lends itself to dangers that might momentarily convert hostilities into a general conflagration. It can be stated definitely, however, that President Roosevelt has made and is making moves by which he most earnestly intends to keep the United States neutral, thus reflecting the overwhelming sentiment of the country. But the Administration is aware, of course, that the way of the neutral is hard.

The embargo list includes specified products which cannot be shipped from the United States to either Italy or Ethiopia under any circumstances. They cover products of immediate use in warfare, and included such things as rifles, machine guns, howitzers, ammunition, bombs, vessels of war, tanks, aircraft, aircraft engines, etc., but do not include raw or other materials which may be fashioned into implements of war.

The embargo list was included in a proclamation issued under the neutrality act passed by Congress shortly before adjournment. The proclamation declared that a state of war exists between Ethiopia and Italy. It warned American citizens voluntarily engaging in "transactions of any character" with either of the two countries that they would "do so at their own risk," accepted generally as breaking away from the traditional attitude of the United States in insisting upon trading rights and freedom of the seas so far as Italy and Ethiopia are concerned.

Supplementing this move, the President last Sunday issued another proclamation admonishing American citizens that they may travel on Italian and Ethiopian ships at their own risk. Inasmuch as Ethiopia has no merchant marine, the proclamation necessarily applied only to Italian vessels. This move also was unprecedented as it affects American policy, and whatever may be the effect was further evidence of the desire of the Administration to prevent the United States from getting entangled in war.

The proclamation declaring that a state of war exists between Italy and Ethiopia followed State Department regulations of Sept. 25, for the registration of manufacturers and handlers of arms, munitions and implements of war. The list of products carried in the regulations is the same as that contained in the proclamation declaring the existence of a state of war. The regulations provide that all persons engaged in manufacturing the products listed shall register with the Secretary of State on or before Nov. 29. The registration fee is $500, as provided in the neutrality act. Registrants are required to obtain a license to export or import arms. This licensing system applies to all countries, while the embargo list so far applies only to Italy and Ethiopia.

Except as it supplies makers of the embargo list, the iron and steel industry is not affected by the embargo list. For that matter shipments by the American iron and steel industry to Ethiopia have been nil this year, while exports to Italy have been extremely small, except for scrap. Exports of scrap to Italy in the first eight months of the current year totaled 237,808 gross tons, the largest monthly shipments being in July when they aggregated 62,169 tons. The previous largest shipments in any single month were in February when the total was 33,269, closely approached by August shipments of 33,078 tons. The largest shipments of finished steel to Italy were black steel sheets and tin plate, and they amounted to only 1831 and 2627 tons respectively during the seven-month period.

Pittsburgh May Get 96-in. Strip Mill

THE American Sheet & Tin Plate Co., a subsidiary of the United States Steel Corpn., is reported to be considering the construction of a 96-in. strip mill in the vicinity of Pittsburgh. The project, however, strictly in the "conversational" stage, and, according to official comment, definite progress will not be made until business conditions improve further. The mill under discussion would have a capacity of approximately 700,000 tons of strip. The plant probably would be so located as to benefit by the lowest freight rate on semi-finished steel, which presumably would be furnished by another United States Steel Corpn. subsidiary. The American Sheet & Tin Plate Co.'s present annual ingot capacity in the Pittsburgh district is only 340,000 tons of basic open-hearth steel.

Edward L. Ryerson, Jr., has been elected vice-chairman of the board of the Inland Steel Co. This action follows the recent consolidation of Inland Steel Co. and Joseph T. Ryerson & Son, Inc., at which time Mr. Ryerson was elected a director of the Steel company. Mr. Ryerson is also a director of the New York Life Insurance Co., Northern Trust Co., Quaker Oats Co. and the American Brake Shoe & Foundry Co. He is also a fellow of the Yale Corporation and a trustee of the University of Chicago.

September Pig Iron Output Up 4.2 Per Cent

PRODUCTION of coke pig iron in September totaled 1,776,476 gross tons, compared with 1,761,286 tons in August. The daily rate in September, at 59,216 tons, increased 4.2 per cent over the August rate of 56,816 tons.

There were 104 furnaces in blast on Oct. 1, making iron at the rate of 59,250 tons a day, against 99 furnaces on Sept. 1, making iron at the rate of 56,815 tons a day. Eight furnaces were blown in during the month and three were blown out or banked. The Steel Corporation put three furnaces in operation, independent steel companies put one in blast and took three off blast, and merchant producers blew in four furnaces.

Among the furnaces blown in were the following: One Edgar Thomson, one Mingo, and one South Chicago (old), Carnegie-Illinois Steel Corpn.; one Lackawanna, Bethlehem Steel Corpn.; Brooke, E. & G. Brooke Iron Co.; Perry, Pickands, Mather & Co.; Globe, Globe Iron Co., and Jisco, Jackson Iron & Steel Co.

Furnaces blown out or banked included a Donner and a Haselton furnace of the Republic Steel Corpn., and the Norton furnace of the American Rolling Mill Co.

Merchant Iron Made, Daily Rate

Tons

	1935	1934	1933	1932
January	3,926	7,800	2,602	6,256
February	6,288	7,071	2,863	7,251
March	7,089	7,197	2,412	7,157
April	8,799	8,838	1,908	5,287
May	8,441	9,099	3,129	4,658
June	7,874	9,499	4,088	6,090
July	8,644	7,880	6,783	3,329
August	8,194	6,043	7,756	3,070
September	10,090	4,986	10,034	3,213
October	....	5,765	8,634	4,286
November	....	6,610	7,639	4,435
December	....	4,399	8,358	3,674

Daily Average Production of Coke Pig Iron

Gross Tons

	1935	1934	1933	1932
January	47,656	39,201	18,348	31,380
February	57,448	45,131	19,798	33,251
March	57,098	52,243	17,484	31,201
April	55,449	57,561	20,787	28,430
May	55,713	65,900	28,621	25,276
June	51,750	64,338	42,166	20,935
½ year	54,138	54,134	24,536	28,412
July	49,041	39,510	57,821	18,461
August	56,816	34,012	59,142	17,115
September	59,216	29,935	50,742	19,753
October	.....	30,679	43,754	20,800
November	.....	31,898	36,174	21,042
December	.....	33,149	38,131	17,615
Year	.....	43,592	36,199	23,733

Production of Coke Pig Iron and Ferromanganese

Gross Tons

	Pig Iron*		Ferromanganese†	
	1935	1934	1935	1934
January	1,477,336	1,215,226	10,048	11,703
February	1,608,552	1,263,673	12,288	10,818
March	1,770,028	1,619,534	17,762	17,605
April	1,663,475	1,726,851	18,302	15,418
May	1,727,095	2,042,896	17,541	10,001
June	1,552,514	1,930,133	12,961	10,007
½ year	9,799,000	9,798,313	88,902	75,642
July	1,520,263	1,224,826	13,175	10,188
August	1,761,286	1,054,382	12,735	8,733
September	1,776,476	898,043	15,983	7,100
October	.....	951,062	.....	9,830
November	.....	956,940	.....	8,134
December	.....	1,027,622	.....	4,563
Year	.....	15,911,188	.....	124,190

*These totals do not include charcoal pig iron. The 1934 production of this iron was 25,834 gross tons.

†Included in pig iron figures.

Production by Districts and Coke Furnaces in Blast

Furnaces	Production (Gross Tons)		October 1		September 1	
	September (30 Days)	August (31 Days)	Number in Blast	Operating Rate, Tons a Day	Number in Blast	Operating Rate, Tons a Day
New York:						
Buffalo	101,956	115,579	7	3,980	7	3,730
Other New York and Mass.	12,680	13,121	1	425	1	345
Pennsylvania:						
Lehigh Valley	34,637	32,484	3	1,155	3	1,050
Schuylkill Valley	11,207	12,010	2	510	1	385
Susquehanna and Lebanon Valleys	11,338	13,019	1	380	1	420
Ferromanganese	....	....	0	....	0	....
Pittsburgh District	352,857	359,205	21	12,000	20	11,705
Ferro. and Spiegel	7,181	4,311	1	240	1	140
Shenango Valley	34,182	22,335	2	1,140	2	945
Western Pennsylvania	42,961	39,647	3	1,560	2	1,280
Ferro. and Spiegel	5,910	5,409	1	195	1	175
Maryland	76,930	75,513	3	2,565	3	2,435
Wheeling District	128,751	125,774	7	4,345	6	3,975
Ohio:						
Mahoning Valley	173,632	182,361	7	5,020	8	5,840
Central and Northern	174,664	178,459	11	5,820	*11	*5,755
Southern	40,922	32,187	4	1,390	2	1,040
Illinois and Indiana	355,287	349,673	16	11,865	15	10,645
Mich. and Minn.	71,114	68,701	4	2,370	4	2,215
Colo, Mo. and Utah	21,758	23,171	2	725	2	745
The South:						
Virginia	....	....	0	....	0	....
Ferro and Spiegel	2,892	3,015	1	95	1	95
Kentucky	24,312	25,215	1	425	2	815
Alabama	91,305	80,097	6	3,045	6	3,080
Tennessee	....	....	0	....	0	....
Total	1,776,476	1,761,286	104	59,250	99	56,815

*Corrected figure. A Toledo furnace of the Interlake Iron Corpn. was reported out in error last month.

Railroad Equipment

Cincinnati, New Orleans & Texas Pacific has increased original order to Pressed Steel Car Co. for 300 40-ton automobile cars to 500 cars.

Mexican Railway has received delivery of 50 40-ton box cars from Koppel Industrial Car & Equipment Co.

Chicago, Burlington & Quincy contemplates purchasing a fourth car for each of its twin Zephyrs.

RAILS AND TRACK SUPPLIES

Chesapeake & Ohio has awarded 21,842 tons of 131-lb. rails, dividing the order as follows: Carnegie-Illinois Steel Corpn. 13,232 tons, of which the Illinois division received 9414 tons and Carnegie 2818 tons; Inland Steel Co. 7426 tons; Bethlehem Steel Co. 2184 tons. This road has also distributed orders for about 1000 tons of tie plates, splice bars and spikes.

Orders received by the General Electric Co. in the third quarter amounted to $54,400,819, compared with $40,458,901 in the third quarter of 1934, an increase of 34 per cent. Orders received in the nine months amounted to $158,943,765, compared with $132,613,543 in the nine months last year, an increase of 20 per cent.

Capital Goods Index Affected By Coal Strike

GAINS were recorded last week by three of the separate indices measuring operations in the heavy industries, but a hampering influence continues to be exerted upon the combined index by the Pittsburgh district component. Owing to the coal walkout two weeks ago, production of coal in that area dropped 85 per cent below prior levels.

Shipments were correspondingly affected, and, to a slighter degree, iron and steel operating rates and electric power output were retarded. As a result, the capital goods index figure for two weeks ago has been revised materially downward. Owing to necessary use of a moving average in calculating the Pittsburgh district index, the events of two weeks ago have had a carry-over effect on last week's estimate.

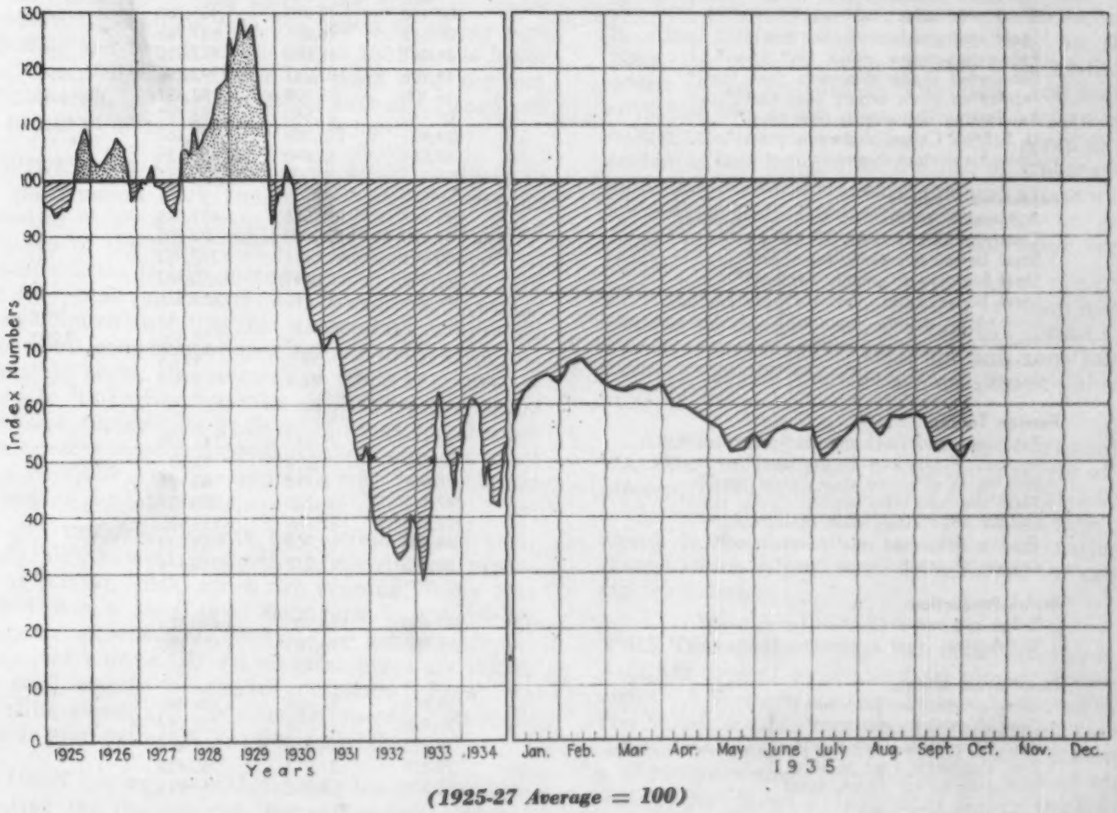
Properly regarded, however, such accidental factors are unimportant in gaging industrial activity. Steel ingot production was higher last week, as were automobile production and construction contracts awarded. Lumber shipments showed a slight contraseasonal decline.

Viewed from all angles, the current reading of 53.3 for THE IRON AGE index, which is higher than for any corresponding annular period since 1930, reflects the sound position in which business finds itself. Forecasts for the remainder of the year are even brighter.

The Iron Age Weekly Index Numbers of Capital Goods Activity

(1925-'27 = 100)

Last week (est.)	53.3
Preceding week (rev.)	50.3
Same week last month	57.4
Same week 1934	40.6
Same week 1933	50.7
Same week 1932	32.6
Same week 1931	52.5
Same week 1930	77.0
Same week 1929	113.1



The Iron Age Index of Capital Goods Activity. The years 1925 to 1934 are plotted by months, the current year by weeks.

Components of the index: Steel ingot production rate, from THE IRON AGE; revenue freight carloadings of forest products, from Association of American Railroads; automobile production, from Cram's Automotive Reports; heavy construction contract awards, from *Engineering News Record;* index of productive activity in Pittsburgh district, from Bureau of Business Research of University of Pittsburgh.

Current Metal Working Activity Statistically Shown

These Data Are Assembled by The Iron Age from Recognized Sources and Are Changed Regularly as More Recent Figures Are Made Available.

	September, 1935	August, 1935	September, 1934	Nine Months, 1934	Nine Months, 1935
Raw Materials:					
Lake ore consumption (gross tons)[a]	.....	2,615,927	1,236,392	18,003,319	.....
Coke production (net tons)[b]	.....	2,833,707	2,228,400	24,572,700	.....
Pig Iron:					
Pig iron output—monthly (gross tons)[c]	1,776,476	1,761,286	898,000	12,976,000	14,857,025
Pig iron output—daily (gross tons)[c]	59,216	56,816	29,935	39,819	56,523
Castings:					
Malleable castings—production (net tons)[d]	.....	35,245	21,541	282,880	.....
Malleable castings—orders (net tons)[d]	.....	35,602	19,511	270,326	.....
Steel castings—production (net tons)[d]	.....	.....	31,816	371,230	.....
Steel castings—orders (net tons)[d]	.....	.....	20,030	360,933	.....
Steel Ingots:					
Steel ingot production—monthly (gross tons)[c]	2,829,835	2,919,326	1,268,977	20,542,334	24,044,076
Steel ingot production—daily (gross tons)[c]	113,193	108,123	50,759	88,165	103,193
Steel ingot production—per cent of capacity[c]	51.13	48.84	23.05	40.04	46.61
Employment in Steel Industry:					
Total employees[c]	.....	423,925	381,828	402,223	.....
Total payrolls (thousands of dollars)[c]	.....	$47,890	$29,143	$356,819	.....
Average hours worked per week[c]	.....	35.0	24.2	28.2	.....
Finished Steel:					
Trackwork shipments (net tons)[c]	.....	4,028	3,383	42,620	.....
Sheet steel sales (net tons)[f]	.....	207,140	77,063	1,401,288	.....
Sheet steel production (net tons)[f]	.....	206,613	76,051	1,487,765	.....
Fabricated shape orders (net tons)[g]	.....	86,047	66,586	832,520	.....
Fabricated shape shipments (net tons)[g]	.....	114,906	105,233	792,796	.....
Fabricated plate orders (net tons)[d]	.....	19,305	15,108	182,757	.....
Reinforcing bar awards (net tons)[e]	.....	101,140	7,550	158,280	.....
U. S. Steel Corpn. shipments (tons)[h]	.....	624,497	370,306	4,797,162	.....
Ohio River steel shipments (net tons)[i]	.....	92,501	45,848	488,125	.....
Fabricated Products:					
Automobile production, U. S. and Canada[k]	.....	247,743	175,586	2,492,695	.....
Construction contracts, 37 Eastern States[l]	.....	$168,557,200	$110,151,200	$1,203,507,200	.....
Steel barrel shipments (number)[d]	.....	600,993	417,114	5,215,953	.....
Steel furniture shipments (dollars)[d]	.....	1,327,252	879,243	8,680,862	.....
Steel boiler orders (sq. ft.)[d]	.....	542,606	539,242	3,367,525	.....
Locomotive orders (number)[m]	7	0	1	89	28
Freight car orders (number)[m]	110	100	4	23,000	7,293
Machine tool index[n]	.....	125.8	36.2	†37.4	.....
Foundry equipment index[o]	.....	113.0	46.4	†46.7	.....
Foreign Trade:					
Total iron and steel imports (gross tons)[p]	.....	31,312	23,847	241,579	.....
Imports of pig iron (gross tons)[p]	.....	8,568	12,290	99,091	.....
Imports of all rolled steel (gross tons)[p]	.....	17,657	8,196	85,986	.....
Total iron and steel exports (gross tons)[p]	.....	247,312	301,330	2,030,637	.....
Exports of all rolled steel (gross tons)[p]	.....	82,866	72,165	723,485	.....
Exports of finished steel (gross tons)[p]	.....	64,400	69,302	634,833	.....
Exports of scrap (gross tons)[p]	.....	156,685	225,212	1,275,414	.....
British Production:					
British pig iron production (gross tons)[r]	.....	543,400	500,300	4,430,300	.....
British steel ingot production (gross tons)[r]	.....	759,900	734,700	6,627,200	.....
Non-Ferrous Metals:					
Lead production (net tons)[s]	.....	34,856	31,939	304,845	.....
Lead shipments (net tons)[s]	.....	38,195	36,018	277,547	.....
Zinc production (net tons)[t]	.....	35,922	26,515	261,448	.....
Zinc shipments (net tons)[t]	.....	39,200	21,913	260,438	.....
Deliveries of tin (gross tons)[v]	.....	5,320	3,850	33,915	.....

*Preliminary. †Three Months' Average.

Source of figures: [a] Lake Superior Iron Ore Association; [b] Bureau of Mines; [c] THE IRON AGE; [d] Bureau of the Census; [e] American Iron and Steel Institute; [f] National Association of Flat-Rolled Steel Manufacturers; [g] American Institute of Steel Construction; [h] Unitel States Steel Corpn.; [i] United States Engineer, Pittsburgh; [k] When preliminary, from Automobile Manufacturers Association—Final figures from Bureau of the Census; [l] F. W. Dodge Corpn.; [m] *Railway Age;* [n] National Machine Tool Builders Association; [o] Foundry Equipment Manufacturers Association; [p] Department of Commerce; [r] British Iron and Steel Federation; [s] American Bureau of Metal Statistics; [t] American Zinc Institute, Inc.; [v] New York Commodities Exchange.

SUMMARY OF THIS WEEK'S BUSINESS

Output Dips Pending Receipt of Heavier Automotive Orders

Ingot Rate Recedes to 52 Per Cent—Higher Coke Prices Foreshadow Advances In Pig Iron Prices—Scrap Index in First Decline Since June

AUTOMOTIVE demand for steel, though held back by model delays and by Detroit's recent preoccupation with the "World's Series," has shown moderate improvement. The gain, however, was insufficient to prevent a slight falling off in steel ingot production, the present national rate being 52 per cent, as compared with 52½ per cent a week ago. In certain centers further increases in output are reported, but this betterment was more than offset by losses elsewhere. Operations rose five points to 46 per cent at Buffalo and two points to 84 per cent in the lower Ohio River valley, but dipped one point to 45 per cent at Pittsburgh, one point to 59 per cent at Chicago and two points to 53 per cent in the Valleys.

A WIDENING outlet for heavy rolled products in construction work and in Navy vessels, supplemented by a fair aggregate of rail orders, has raised the hopes of the trade that steel demand as a whole will suffer little, if any, recession, even though orders from the motor car industry fail to come up to expectations. Notwithstanding that uncertainty will prevail as to retail reception of new models until after the automobile show, the automotive trade continues to adhere to its earlier forecasts of 700,000 to 750,000 assemblies during this quarter. Output for October is expected to approach 200,000 units, with the exact figure depending on the rapidity with which motor car makers get into full operations.

Farm equipment plants have again raised their already high rate of production, following an expansion of foreign sales, which are running 75 per cent heavier than a year ago. Refrigerator makers are placing larger orders for steel as they get into production on new models. Barrel manufacturers are taking more steel, mainly for alcohol containers. Producers of heating stoves and furnaces are speeding up operations in step with cold weather demands.

PIG IRON buying, notwithstanding heavy prior contracting for this quarter, remains active. Higher prices now seem certain before Jan. 1, since expected advances in fuel costs have now materialized. Connellsville furnace coke for prompt shipment has risen 35c. a ton to $3.60, ovens, and foundry coke is up 25c. to $4.25, ovens.

It is less certain that steel prices will reflect the advance in fuel costs, though it is perhaps significant that reports of scattered deviations from the market on a number of products are disappearing. Scrap, the most sensitive barometer of the iron and steel industry, has suffered a setback. A decline of 50c. a ton in heavy melting steel at Philadelphia has depressed THE IRON AGE composite price for scrap (averaged from the Philadelphia, Chicago and Pittsburgh prices) from $12.83 to $12.67 a ton. This is the first recession in the index since the second week in June, but may be overemphasized. In the first place, the price of heavy melting steel at St. Louis, which is not included in THE IRON AGE index, has advanced 50c. a ton. Secondly, the African war has halted sales of scrap to Italy. While scrap is not expected to be included in the list of embargoed war materials, Atlantic seaboard shippers are unwilling to make new Italian commitments except on an f.o.b. American port basis, with the purchaser supplying the bottoms.

Finished steel demand has not yet been materially affected by the outbreak of hostilities abroad. Only a few scattered inquiries from the war zone have been received, among them two from Egypt for oil can sizes of tin plate.

American tin plate makers are less concerned about the effect of the war on exports than its effect on prices. There is already some evidence of reluctance to announce the customary quotations for nine months ahead, in the face of an uncertain international exchange which might seriously influence the course of pig tin prices.

THE Chesapeake & Ohio has distributed orders for 21,842 tons of rails and 1000 tons of track accessories. A Western road has bought 2400 tons of rails. The Mobile & Ohio has placed 2000 tons of rails with the Alabama mill. The Navy Department has awarded a 10,000-ton cruiser, requiring 7000 tons of steel, to the Newport News Shipbuilding & Dry Dock Co.

Structural steel awards total 20,100 tons, compared with 17,025 tons in the previous week. New projects, at 47,365 tons, are the largest since the last week in June.

THE IRON AGE composite prices for pig iron and finished steel are unchanged at $17.84 a gross ton and 2.130c. a lb. respectively.

A Comparison of Prices

Market Prices at Date, and One Week, One Month, and One Year Previous; Advances Over Past Week in Heavy Type, Declines in Italics

Pig Iron

Per Gross Ton:	Oct. 8, 1935	Oct. 1, 1935	Sept. 10, 1935	Oct. 9, 1934
No. 2 fdy., Philadelphia	$20.3132	$20.3132	$20.3132	$20.26
No. 2, Valley furnace	18.50	18.50	18.50	18.50
No. 2 Southern, Cin'ti	19.2007	19.2007	19.2007	19.13
No. 2, Birmingham†	14.50	14.50	14.50	14.50
No. 2 foundry, Chicago*	18.50	18.50	18.50	18.50
Basic, del'd eastern Pa.	19.8132	19.8132	19.8132	19.76
Basic, Valley furnace	18.00	18.00	18.00	18.00
Malleable, Chicago*	18.50	18.50	18.50	18.50
Malleable, Valley	18.50	18.50	18.50	18.50
L. S. charcoal, Chicago	24.7528	24.7528	24.2528	24.04
Ferromanganese, seab'd carlots	85.00	85.00	85.00	85.00

†This quotation is for delivery in South; in the North prices are 38c. a ton under delivered quotations from nearest Northern furnace.

*The switching charge for delivery to foundries in the Chicago district is 60c. per ton.

Rails, Billets, etc.

Per Gross Ton:				
Rails, heavy, at mill	$36.37½	$36.37½	$36.37½	$36.37½
Light rails, Pittsburgh	35.00	35.00	35.00	35.00
Rerolling billets, Pittsburgh	27.00	27.00	27.00	27.00
Sheet bars, Pittsburgh	28.00	28.00	28.00	28.00
Slabs, Pittsburgh	27.00	27.00	27.00	27.00
Forging billets, Pittsburgh	35.00	35.00	35.00	32.00
Wire rods, Pittsburgh	38.00	38.00	38.00	38.00
	Cents	Cents	Cents	Cents
Skelp, grvd. steel, P'gh, lb.	1.70	1.70	1.70	1.70

Finished Steel

Per Lb.:	Cents	Cents	Cents	Cents
Bars, Pittsburgh	1.85	1.85	1.80	1.80
Bars, Chicago	1.90	1.90	1.85	1.85
Bars, Cleveland	1.90	1.90	1.85	1.85
Bars, New York	2.20	2.20	2.15	2.13
Plates, Pittsburgh	1.80	1.80	1.80	1.80
Plates, Chicago	1.85	1.85	1.85	1.85
Plates, New York	2.09	2.09	2.09	2.08
Structural shapes, Pittsburgh	1.80	1.80	1.80	1.80
Structural shapes, Chicago	1.85	1.85	1.85	1.85
Structural shapes, New York	2.06¼	2.06¼	2.06¼	2.05¼
Cold-finished bars, Pittsburgh	1.95	1.95	1.95	2.10
Hot-rolled strips, Pittsburgh	1.85	1.85	1.85	1.85
Cold-rolled strips, Pittsburgh	2.60	2.60	2.60	2.60

Finished Steel

Per Lb.:	Oct. 8, 1935 Cents	Oct. 1, 1935 Cents	Sept. 10, 1935 Cents	Oct. 9, 1934 Cents
Hot-rolled annealed sheets, No. 24, Pittsburgh	2.40	2.40	2.40	2.40
Hot-rolled annealed sheets, No. 24, Gary	2.50	2.50	2.50	2.50
Sheets, galv., No. 24, P'gh	3.10	3.10	3.10	3.10
Sheets, galv., No. 24, Gary	3.20	3.20	3.20	3.20
Hot-rolled sheets, No. 10, P'gh	1.85	1.85	1.85	1.85
Hot-rolled sheets, No. 10, Gary	1.95	1.95	1.95	1.95
Wire nails, Pittsburgh	2.40	2.40	2.40	2.60
Wire nails, Chicago dist. mill	2.45	2.45	2.45	2.65
Plain wire, Pittsburgh	2.30	2.30	2.30	2.30
Plain wire, Chicago dist. mill	2.35	2.35	2.35	2.35
Barbed wire, galv., P'gh	2.80	2.80	2.80	3.00
Barbed wire, galv., Chicago dist. mill	2.85	2.85	2.85	3.05
Tin plate, 100 lb. box, P'gh	$5.25	$5.25	$5.25	$5.25

Scrap

Per Gross Ton:				
Heavy melting steel, P'gh	$13.50	$13.50	$13.25	$10.25
Heavy melting steel, Phila	12.00	12.50	12.50	9.50
Heavy melting steel, Ch'go	12.50	12.50	12.50	8.75
Carwheels, Chicago	12.75	12.75	12.75	9.50
Carwheels, Philadelphia	12.75	11.75	11.75	11.25
No. 1 cast, Pittsburgh	14.25	14.25	14.25	11.25
No. 1 cast, Philadelphia	11.75	11.75	11.75	11.75
No. 1 cast, Ch'go (net ton)	11.25	11.25	11.25	8.00
No. 1 RR. wrot., Phila	12.25	12.25	12.25	11.25
No. 1 RR. wrot., Ch'go (net)	9.50	9.50	9.50	7.00

Coke, Connellsville

Per Net Ton at Oven:				
Furnace coke, prompt	$3.60	$3.25	$3.25	$3.85
Foundry coke, prompt	4.25	4.00	4.00	4.60

Metals

Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Electrolytic copper, refinery	9.00	8.75	8.25	9.12½
Lake copper, New York	9.37½	9.12½	8.62½	8.75
Tin (Straits), New York	51.00	50.15	48.25	50.75
Zinc, East St. Louis	4.85	4.75	4.60	3.87½
Zinc, New York	5.22½	5.12½	4.97½	4.22½
Lead, St. Louis	4.45	4.35	4.20	3.45
Lead, New York	4.60	4.50	4.35	3.60
Antimony (Asiatic), N. Y.	14.40	14.25	13.00	9.00

On export business there are frequent variations from the above prices. Also, in domestic business, there is at times a range of prices on various products, as shown in our detailed price tables.

The Iron Age Composite Prices

	Finished Steel	Pig Iron	Steel Scrap
Oct. 8, 1935	2.130c. a Lb.	$17.84 a Gross Ton	$12.67 a Gross Ton
One week ago	2.130c.	17.84	12.83
One month ago	2.124c.	17.84	12.75
One year ago	2.124c.	17.90	9.50
	Based on steel bars, beams, tank plates, wire, rails, black pipe, sheets and hot-rolled strips. These products make 85 per cent of the United States output.	Based on average of basic iron at Valley furnace and foundry irons at Chicago, Philadelphia, Buffalo, Valley and Birmingham.	Based on No. 1 heavy melting steel quotations at Pittsburgh, Philadelphia and Chicago.

	Finished Steel High	Finished Steel Low	Pig Iron High	Pig Iron Low	Steel Scrap High	Steel Scrap Low
1935	2.130c., Oct. 1	2.124c., Jan. 8	$17.90, Jan. 8	$17.83, May 14	$12.83, Oct. 1	$10.33, April 23
1934	2.199c., April 24	2.008c. Jan. 2	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept. 25
1933	2.015c., Oct. 3	1.867c., April 18	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1932	1.977c., Oct. 4	1.926c., Feb. 2	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.43, July 5
1931	2.037c., Jan. 13	1.945c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1930	2.273c., Jan. 7	2.018c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929	2.317c., April 2	2.273c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3
1928	2.286c., Dec. 11	2.217c., July 17	18.59, Nov. 27	17.04, July 24	16.50, Dec. 31	13.08, July 2
1927	2.402c., Jan. 4	2.212c., Nov. 1	19.71, Jan. 4	17.54, Nov. 1	15.25, Jan. 11	13.08, Nov. 22

Pittsburgh Output Recedes To 45 Per Cent

Valley Rate Falls to 53 Per Cent But Wheeling District Average Holds at 80 Per Cent—Coke Prices Advance

PITTSBURGH, Oct. 8.—Finished steel demand in this district, while lacking in any new angles, still is featured by its steadiness. The staying powers of miscellaneous business, which represents the bulk of current shipments out of this district, are particularly encouraging in the face of a slow, almost negligible expansion in automobile steel orders here. Only in the case of strip steel is any improvement noticeable in orders from automotive centers.

Further recession in tin plate orders, with a consequent slackening in tin mill output, is the dominant factor in a one-point drop in raw steel production in the Pittsburgh district to 45 per cent of capacity. In the Wheeling district operations for the fifth consecutive week are steady at 80 per cent. A slight shrinkage in miscellaneous bookings accounts for a two-point drop to 53 per cent of capacity in the Valleys and nearby northern Ohio mills.

The trend in finishing mill output is mixed. Hot strip steel production has risen several points to around 50 per cent, while sheet output is holding at 70 per cent. Tin plate production has fallen five points to 50 per cent, with prospects of further recessions. The cold-finished bar industry now has attained an average output between 40 and 50 per cent, compared with 28 per cent a week or two ago. Current schedules are still based partly on tonnage booked in September for October shipment, and expected spot tonnage booked in October probably will provide producers with moderate backlogs through the month.

Any easy tendencies in the steel price structure are being overshadowed by the higher producing costs for coal and coke. Most "captive" mine owners have agreed to the new bituminous wage scale, and both integrated and non-integrated steel makers will have to assume higher fuel costs. In the commercial fuel market bituminous coal has been advanced an average of 15c. a ton, while furnace and foundry coke has been advanced 25 to 35c. a ton.

The Allegheny County Authority's PWA program, entailing expenditure of $24,165,000 has been slashed to $7,667,000, eliminating four of the nine major projects. The Fort Duquesne bridge and tunnels, wharf improvements, the Glenwood bridge, and Liberty Tubes Plaza have been abandoned. Constructional steel requirements consequently will be only a small fraction of the authority's original program estimated to require well over 100,000 tons.

Pig Iron

Demand remains largely on a spot basis, with October volume running slightly behind that for the first week in September. Foundry melt in this district is spotty, the only sustained intake of pig iron being at mill equipment plants. River movement of steel-making grades may spurt toward the close of this month in anticipation of winter navigation conditions. Prices have disregarded the apathetic demand in this district and have firmed as a result of higher coke costs.

Semi-Finished Steel

New orders since Oct. 1 have been in rather moderate volume where revised extras became effective. On other items carried over into fourth quarter at unchanged prices demand continues even. A further slackening in sheet bar movement for tin plate conversion has been offset by comparable increases in shipments to detached sheet mills. Improved demand for forging stock and other items incidental to automobile manufacture thus far has failed to be impressive.

Bolts, Nuts and Rivets

A moderate general pick-up in specifications, with improvement most noticeable in automotive releases, has occurred since the beginning of the month. Total volume of business, however, still is far below "normal." The new discounts seem to be holding firmly, although at some scattered points competition remains severe.

Rails and Track Acessories

The Chesapeake & Ohio Railroad has distributed orders for 21,842 tons of 131-lb. rails for delivery by the end of 1935. Of the total, Carnegie-Illinois Steel Corpn. received combined orders for 13,232 tons, of which 9400 tons went to the Illinois division and 2818 tons to Carnegie at Pittsburgh. The Carnegie share is for prompt delivery. Inland Steel Co. was awarded 7426 tons and Bethlehem Steel Co. 2184 tons. The only other important inquiry now reported in this district is for about 10,000 tons for Norfolk & Western, which closes bids on Oct. 16.

Reinforcing Steel

State road lettings hold the center of the stage, while private projects are becoming more evident. A substantial tonnage of mesh and bars is being bid in the Pennsylvania State lettings on Oct. 11. Reinforcing material also will be required for the Chevrolet Motor Co. body plant at Indianapolis. Distributers' prices appear to be a shade firmer.

Cold-Finished Bars

Orders booked on the new card of extras effective Oct. 1, while not comparable in volume with the anticipatory tonnage entered late in September, are equaling the rate set in August. Specifications against late September bookings are heavy and, combined with new spot tonnage, have forced producers to step up output markedly, with the average output for the cold-finished industry now running between 40 and 50 per cent.

Tubular Products

Aggregate volume has shown a slight increase, provided by the impetus of better demand for oil country goods. On the whole, however, demand is following no definite trend, with slight fluctuations continuing in weekly volume. Carlot buying of locomotive boiler tubes, while in greater evidence, is still regarded as spotty. Mechanical tubing has not received noticeable aid thus far from new model motor car construction. A possible increase in calls for drill pipe and casing is considered in the making in east Texas, where drilling during the next two months is slated for wider activity. Operations continue at around 40 to 45 per cent.

Bars

The trend of demand is even and still lacks the influence of notice-

ably heavier automotive tonnage. The influx of such business, expected this month, will force bar mills almost immediately into higher rolling schedules. Miscellaneous business shows no signs of slackening, with an unusually well sustained movement to the farm implement and machinery industry. Some requests have been made by groups of consumers for the privilege of combining orders in order to earn the deductions in the higher quantity brackets set up in the new list of extras announced last month. The new Pittsburgh base of 1.85c. a lb. has been applied to all new business since Oct. 1.

Wire Products

Producers in this district are rather comfortably booked with anticipatory tonnage entered in September, and a free flow of specifications against those orders is tending to sustain wire mill operations at around 45 to 50 per cent.

Plates and Shapes

The United States Engineer office at Pittsburgh is taking bids until Oct. 12 on four steel scows, requiring about 400 tons of plates. About 300 tons of plates will be needed for 12 tanks at Erie, Pa., on which bids are being taken by Gulf Refining Co.

Sheets

Demand is unusually well maintained despite the lack of heavier buying by the automotive industry. In the past week new orders increased materially from manufacturers of electrical equipment, stoves, lockers and barrels. New tonnage reported by a leading producer for the week was the heaviest for any period since February. The automobile industry is reported to have sufficient flat-rolled steel to cover its requirements until mid-November, and any new orders placed in the near future will be for assemblies beyond that time. Output for the sheet industry this week is expected to hold at 70 per cent of capacity. Excepting some irregularities in quotations on galvanized roofing in the Southwest, quotations for all other grades of sheets evidently are resisting weakness.

Tin Plate

Releases are coming in rather slowly, and mill stocks of tin plate produced against orders have not been materially reduced. In fact, stocks at the mills are reported to be well above a normally rated surplus. At least a small measure of relief is expected to be provided by the placing of releases for late crop packing requirements. Output of the leading producer is well sustained, but losses in other directions have forced the average output for the industry down five points to about 50 per cent.

Strip Steel

Bookings from the automotive industry have shown a measurable increase in the past 10 days, and additional expansion in automobile demand is looked for by strip producers this month. Stainless strip is benefiting materially by heavier automoible demand. There also is a slight upturn in calls from miscellaneous consumers.

Warehouse Business

For Pittsburgh delivery, hot-rolled flats, rounds and angles under 3 in. have been advanced 5c. a 100 lb. to a base of 2.95c. a lb. All other hot-rolled bars, including squares, hexagons, ovals, half ovals, round-edge flats, half rounds, channels under 3 in., and other small shapes have been increased 20c. a 100 lb. to 3.10c. a lb., Pittsburgh delivery. While extras for cold-finished and screw stock have been revised to reflect the mill changes on Oct. 1, no change in the base price has been made.

Coal and Coke

Preliminary advances averaging 15c. to 20c. a ton in prices for commercial grades of bituminous coal have been effected. Connellsville furnace coke for prompt shipment has been advanced 35c. a ton to $3.60, ovens, and foundry coke 25c. a ton to $4.25, ovens. Premium brands of foundry coke have been advanced on an average of 35c. a ton, with prices ranging from $5.35 to $5.75, ovens. Connellsville domestic coke prices have been increased further, with stove and egg quotable at $3.75 and nut at $3.60, Connellsville ovens. Domestic-sized bituminous coal prices have been stepped up as high as 75c. a ton to a range of $2.50 to $2.75, mines. Some fuel producers, before committing themselves definitely to a new scale of prices, are making payroll studies based upon the new mine wage rates, and probably will make further adjustments in prices later. Current demand is lively only for domestic sizes.

Scrap

Most mills in this district continue to withhold interest in heavy melting steel. The principal small independent steel mills are fairly well covered for the time being and the leading consumer continues to satisfy requirements with production scrap. Dealers with unfilled steel orders still are experiencing difficulty in covering freely at less than $13.50, delivered. A report that No. 1 heavy melting steel on the last Pennsylvania list brought $14.60, delivered, offers a small indication of continued strength in the scrap market. Blast furnace scrap is in better demand, and after a long quiet spell has moved $1 a ton higher.

Weekly Indications of Steel Activity

From THE IRON AGE

	Oct. 8, 1935	Oct. 1, 1935	Sept. 10, 1935	Oct. 9, 1934	Average Year to Date 1935	1934
Steel ingot operations—Per cent of capacity	52.0	52.5	52.5	24.5	46.5	39.3
	Week Ended				Year to Date	
	Oct. 8, 1935	Oct. 1, 1935	Sept. 10, 1935	Oct. 9, 1934	1935	1934
Fabricated structural steel awards	20,100	17,025	25,650	15,700	560,430	622,150
Fabricated plate awards	500	4,200	1,210	1,100	112,487	101,142
Sheet steel piling awards	3,300	3,750	7,500	2,700	51,290	45,750
Reinforcing bar awards	6,750	5,250	3,510	3,300	255,500	163,545

Chicago Rate Off Slightly To 59 Per Cent

Market Outlook Remains Satisfactory — Pig Iron Shipments Are Climbing and New Buying Is in Prospect

CHICAGO, Oct. 8.—Ingot output continues its seesaw action within the limits of one point, the current rate being 59 per cent of capacity in contrast with 60 per cent a week ago. However, both sales and specifications are larger, and there are also other factors that point to betterment in the shipping rate.

Releases from automobile centers are swinging upward, and the trade is firm in its belief that this one source alone will be responsible in the near future for a higher rate of production, assuming, which seems reasonable, that demand from other sources will at least hold steady. Farm implement manufacturers are experiencing another upward swing and every current indication points to continued prosperity for that industry. Weather remains favorable to normal crop development, and the whole agricultural outlook is far better than it was a year ago. This situation is also reflected in demand for wire goods, output of which has been forced well above the 60 per cent mark. The road machinery business is steady, and, all things considered, structural shops are specifying freely.

Rail purchases by the Chesapeake & Ohio and a Western railroad improve the outlook in the transportation field. A prominent railroad official has stated this week that the railroads are badly in need of large quantities of supplies and that purchases cannot much longer be deferred.

The miscellaneous bar trade is more quiet but there seems to be nothing basically wrong in that direction, the change being merely a normal swing that can come and disappear on short notice.

Pig Iron

Shipments continue to climb and sales are again brisk under the influence of continued talk that prices will advance. In fact, the strength of prices is stimulating new inquiry. A number of very attractive tonnages are about to break into the market. The drain against furnace stocks is pointing the way to early lighting of another merchant stack.

Reinforcing Bars

The week has been quiet, though the outlook, based on tonnage pending, is favorable. The 1800 tons needed for the Burlington, Iowa, dam has been placed and the 325 tons for the substructure of a bridge at Benton Harbor, Mich., has been ordered. Fresh inquiries are all small, but they are numerous and most of them are private projects. Although the market is considered quiet at the moment, the trade looks upon the situation as temporary. Shop operations range from 50 to 60 per cent of capacity and there is reasonable assurance that this rate will be maintained. The State of Indiana has ordered a small lot of mesh for paving, but the bulk of its tonnage will not be placed before spring.

Cast Iron Pipe

The only large fresh inquiry in the immediate Chicago territory is one from Milwaukee, which will open bids Oct. 10 on 500 tons of 12-in. pipe. Orders are spotty and all are of small size. The aggregate tonnage, however, is larger than a week ago. The outlook for the future remains uncertain. Some in the trade believe business will revive this fall, but most people interested in cast iron pipe feel that a real upturn will not come before spring. Prices for cast iron pipe remain firm.

Rails

The Illinois unit of the Carnegie-Illinois Steel Corpn. has been awarded 8414 tons of rails by the Chesapeake & Ohio, which has also given 7426 tons to Inland Steel Co. There also has been added to Western producers' books an order for 2500 tons, which was placed late last week by a railroad running west from Chicago. This business has come at an opportune time and is permitting local mills to revise schedules, which now extend to about the middle of November.

Bars

Once again the demand for bar mill products is reaching upward under the stimulus of buying by forging plants that are being called on for a greater number of automobile parts. The farm implement group is moving forward to heavier schedules, partly as a result of increased foreign demand, which is running more than 75 per cent heavier than a year ago. Road machinery builders are enjoying a steady demand for their equipment, and for many months they have been making steady demands against steel mills. The miscellaneous use of bars appears to be a little less active, but the trade looks upon this as only a temporary situation which may not last out this week.

Plates

A lock at Sheffield, Ala., and drum gates at Coal Creek, Tenn., are about the only fresh inquiries that will take more than an ordinary proportion of plates. Mills have been looking longingly to the railroads hoping that something of size would develop, but the only satisfaction to be had is that one Western railroad has started plans which will result in more active repair work. The Burlington contemplates purchasing a fourth car for each of its twin Zephyrs.

Wire Products

September sales were the best in about five years and this is reflected in output which has climbed to a range of 60 to 65 per cent of capacity. Jobbers are taking more wire products, but they are buying on a week-to-week basis, which shows that as a whole they are not satisfied with the new price set-up which will come under heavy discussion at a jobbers' convention to be held in the near future. Price variations, which have been creeping out here and there, are less numerous and the price structure has a stronger tone.

Cold Rolled Strip

Demand is turning up on that class of business which does not afford the most satisfactory mill operations. Most of this improvement is in the East, where a fair part of the cold-rolled strip is being used for automobile hardware and trimmings.

Structural Material

The week has been typical of what the structural market has been for many months. Actual

awards have dropped back to about 2500 tons, including 1600 tons for the first unit of the Chevrolet plant at Indianapolis. On the other hand, fresh inquiries are attractive, totaling about 7500 tons. Releases from shops are in good volume.

Sheets

Operations range between 80 and 90 per cent of capacity, with the prospect that they will go higher as automobile needs climb. Releases from automobile centers are more liberal, but real production schedules do not as yet seem to be under way. Container manufacturers are drawing steadily against steel mills.

Scrap

The major activity in this market is being staged by dealers and brokers, who are scrambling to cover old commitments and if possible take a long position with the expectation that though October will prove to be a quiet month and that upturns in demand and prices will be in order for November. Dealers do not hesitate to pay $12.50, delivered, for a few cars of heavy melting steel. Scrap is being sent to mills faster than they want to unload, and the fact that inspections have been drawn very tight does not keep sellers from pushing every possible car toward mill unloading tracks.

TRADE NOTES

Foote Brothers Gear & Machine Co., Chicago, was recently awarded, through the Independent Bridge Co. contract, all of miter gate, and tainter valve operating machinery for three large locks and dams in the Mississippi River. They are at Red Wing, Minn., Le Claire, Iowa, and New Boston, Iowa.

Tubular Steel Railings—Fabricated Steel Products Co., Wheeling, W. Va. Illustrated circular, describing completely fabricated, ready to install, hand railings, highway railings, etc. Jointless posts, continuous through fittings, eliminate weakness, and concealed welds enhance appearance. Assembly in field requires little effort. Material is fabricated to meet any specifications and promptly delivered.

Foote Brothers Gear & Machine Co., Chicago, has appointed P. E. Welton, Universal Engineering Corpn., Akron, Ohio, as special representative for rubber industry. Mr. Welton will work in conjunction with company's direct factory representative. R. K. Plummer, in northern Ohio territory.

Jonson Engineering Co., New York, has removed offices to 105 East 131st Street.

Thomas S. Gassner Co., Philadelphia, has announced that in addition to its present facilities for fabricating alloy metals and sheet metal work, it is now able to offer complete engineering service; manufacturing and erecting of blower and exhaust equipment which includes ventilating, drying, dust suppression and stock conveying. New department is directed by Charles H. Raub.

Reeves Pulley Co., Columbus, Ind., has arranged with Chain Belt Co., Milwaukee, for distribution of the complete line of Reeves variable speed control equipment on Pacific Coast. Chain Belt Co. maintains Pacific Coast offices at 1414 Santa Fe Avenue, Los Angeles; 909 Harrison Street, San Francisco; 215 Southwest First Avenue, Portland, and 530 First Avenue, South.

Revere Copper & Brass, Inc., has removed Taunton-New Bedford division to 24 North Front Street, New Bedford, Mass.

Keystone Steel & Wire Co., Peoria, Ill., has declared dividend of 50c. a share on common stock, payable Oct. 15. In preceding quarter a dividend of $1 a share was paid prior to which disbursements were at rate of 50c. quarterly.

Independent Pneumatic Tool Co., Chicago, has declared usual extra dividend of 25c. a share in addition to regular quarterly dividend of 75c. a share, both payable Oct. 1.

OBITUARY

OSCAR JUNGGREN, from 1907 to 1922 design engineer of the turbine department of the General Electric Co., died at his home in Schenectady, N. Y., on Sept. 24, aged 70 years. He was born in Sweden and was graduated as a mechanical engineer from the engineering college at Malmo. He became associated with the General Electric Co. in 1891. He was made consulting engineer of the turbine department in 1922.

❖ ❖ ❖

MARIE ROOT, president and general manager of the Root Spring Scraper Co., Kalamazoo, Mich., died Oct. 2 after an extended illness. She entered the business with her father, the late Frederick N. Root, founder of the firm in 1920, and succeeded to the management at his death in 1925.

❖ ❖ ❖

ELMER D. ANDRUS, holder of a medal awarded on completion of 25 years of service with the United States Steel Corpn. as a foreman in the operating and safety departments of the Illinois Steel Co.'s South works, died Oct. 2, aged 82 years.

New Trade Publications

Sintered Carbides—Firth-Sterling Steel Co., McKeesport, Pa. Attractive 32-page booklet describing the various standardized grades and available forms of Firthite. Full page dimensional tables of various styles and sizes include recommended rake angles for cutting various materials. Sections are devoted to suggestions for ordering, and data on designing and making, grinding, and the setting and using of these tools. A 12-page supplementary price list of standard design tools, bits and blanks has also been issued by the company.

Horizontal Boring Mills—Universal Boring Machine Co., Hudson, Mass. Bulletin, 12 pages, describing and illustrating features of the new Nos. 440 and 450 horizontal boring machines, offered with either standard or high-speed spindle ranges. Standard specifications are included, as well as data on special measuring equipment and attachments.

High-Production Tools—Scully-Jones & Co., 1901 South Rockwell Street, Chicago. Catalog No. 105, 143 pages, amply indexed. Tap, drill and other chucks; lathe centers; floating holders; extension sockets; milling machine arbors; end mills; counterbores; carbide-tipped tools; tubes setters; expanders; rivet sets and a variety of other tools are described and illustrated. Dimensional tables are given for all items.

Variable-Speed Drives—Reeves Pulley Co., Columbus, Ind. Small booklet, No. T-7025, entitled "Production Control for Your Machine Tools," illustrates various applications of Reeves units on lathes, milling machines, die sinkers and other tools.

Built-U-Roofing. — Johns-Manville, New York. Illustrated brochure, 24 pages, describing all types of J-M built-up roofs. Condensed specifications for bonded built-up roofs are included.

Shears.—Cincinnati Shaper Co., Cincinnati. Catalog "S," with unusually attractive bled-page illustrations and descriptive data covering its all-steel shears. Tables of capacity ratings for continuous duty and dimensional data are included.

Rolled Steel for Welding.—Illinois Steel Co. and Carnegie Steel Co. combined booklet describing and illustrating the use of rolled steel in machine construction. Forms of steel available, how rolled steel and castings may be combined, welding technique, stress relief, etc., are covered.

Detroit Scrap Prices Unchanged

DETROIT, Oct. 8.—There has been no change in local scrap prices, although the tendency is toward weakness rather than strength. Increased automotive production in the next month is expected to throw a considerably larger volume of old material on to the market.

Prices of Finished Steel and Iron Products

BARS, PLATES, SHAPES

Iron and Steel Bars

Soft Steel — *Base per Lb.*

F.o.b. Pittsburgh .....1.85c.
F.o.b. Chicago .....1.90c.
F.o.b. Gary .....1.90c.
F.o.b. Duluth .....2.00c.
Del'd Detroit .....2.00c.
F.o.b. Cleveland .....1.90c.
F.o.b. Buffalo .....1.95c.
Del'd Philadelphia .....2.16c.
Del'd New York .....2.20c.
F.o.b. Birmingham .....2.00c.
F.o.b. cars dock Gulf ports.....2.25c.
F.o.b. cars Pacific ports .....2.40c.

Rail Steel

(For merchant trade)

F.o.b. Pittsburgh .....1.70c.
F.o.b. Chicago .....1.75c.
F.o.b. Gary .....1.75c.
F.o.b. Moline, Ill. .....1.75c.
F.o.b. Cleveland .....1.75c.
F.o.b. Buffalo .....1.80c.
F.o.b. Birmingham .....1.85c.
F.o.b. cars dock Gulf ports .....2.10c.
F.o.b. cars dock Pacific ports .....2.25.

Billet Steel Reinforcing

(Straight lengths as quoted by distributors)

F.o.b. Pittsburgh .....2.05c.
F.o.b. Chicago .....2.10c.
F.o.b. Gary .....2.10c.
Del'd Detroit .....2.20c.
F.o.b. Cleveland .....2.10c.
F.o.b. Youngstown .....2.10c.
F.o.b. Buffalo .....2.10c.
F.o.b. Birmingham .....2.10c.
F.o.b. cars dock Gulf ports.....2.45c.
F.o.b. cars dock Pacific ports.....2.45c.

Rail Steel Reinforcing

(Straight lengths as quoted by distributors)

F.o.b. Pittsburgh .....1.90c.
F.o.b. Chicago .....1.95c.
F.o.b. Gary .....1.95c.
F.o.b. Cleveland .....1.95c.
F.o.b. Youngstown .....1.95c.
F.o.b. Buffalo .....1.95c.
F.o.b. Birmingham .....1.95c.
F.o.b. cars dock Gulf ports .....2.30c.
F.o.b. cars dock Pacific ports .....2.30c.

Iron

F.o.b. Chicago .....1.80c.
F.o.b. Terre Haute, Ind. .....1.75c.
F.o.b. Louisville, Ky. .....2.10c.
F.o.b. Danville, Pa. .....1.80c.
F.o.b. Berwick, Pa. .....1.70c.

Cold Finished Bars and Shafting*

Base per Lb.

F.o.b. Pittsburgh .....1.95c.
F.o.b. Chicago .....2.00c.
F.o.b. Gary .....2.00c.
F.o.b. Cleveland .....2.00c.
F.o.b. Buffalo .....2.05c.
Del'd Detroit .....2.15c.
Del'd eastern Michigan .....2.20c.

* In quantities of 10,000 to 19,000 lb.

Fence and Sign Posts

Angle Line Posts

Base per Net Ton

F.o.b. Pittsburgh $50.00
F.o.b. Chicago 50.00
F.o.b. Duluth 51.00
F.o.b. Cleveland 50.00
F.o.b. Birmingham 53.00
F.o.b. Houston, Orange, Beaumont, Galveston 59.00
F.o.b. Mobile 58.00
F.o.b. New Orleans, Lake Charles, Corpus Christi 59.00
F.o.b. cars dock Pacific ports..... 63.00

Plates

Base per Lb.

F.o.b. Pittsburgh .....1.80c.
F.o.b. Chicago .....1.85c.
F.o.b. Gary .....1.85c.
Del'd Cleveland .....1.995c.
F.o.b. Coatesville .....1.90c.
F.o.b. Sparrows Point .....1.90c.
Del'd Philadelphia .....1.99c.
Del'd New York .....2.09c.
F.o.b. Birmingham .....1.95c.
F.o.b. cars dock Gulf ports .....2.20c.
F.o.b. cars dock Pacific ports .....2.35c.
Wrought iron plates, f.o.b. P'gh...3.20c.

Floor Plates

F.o.b. Pittsburgh .....3.35c.
F.o.b. Chicago .....3.40c.
F.o.b. Coatesville .....3.45c.
F.o.b. cars dock Gulf ports .....3.75c.
F.o.b. cars dock Pacific ports.....3.90c.

Structural Shapes

Base per Lb.

F.o.b. Pittsburgh .....1.80c.
F.o.b. Chicago .....1.85c.
Del'd Cleve'and .....1.995c.
F.o.b. Buffalo .....1.90c.
F.o.b. Bethlehem .....1.90c.
Del'd Philadelphia .....2.015c.
Del'd New York .....2.0625c.
F.o.b. Birmingham (standard).....1.95c.
F.o.b. cars dock Gulf ports .....2.20c.
F.o.b. cars dock Pacific ports.....2.35c.

Steel Sheet Piling

Base per Lb.

F.o.b. Pittsburgh .....2.15c.
F.o.b. Chicago .....2.25c.
F.o.b. Buffalo .....2.25c.
F.o.b. cars dock Gulf ports .....2.60c.
F.o.b. cars dock Pacific ports.....2.60c.

SHEETS, STRIP, TIN PLATE TERNE PLATE

Sheets

Hot Rolled

Base per Lb.

No. 10, f.o.b. Pittsburgh .....1.85c.
No. 10, f.o.b. Gary .....1.95c.
No. 10, del'd Detroit .....2.05c.
No. 10, del'd Phila. .....2.16c.
No. 10, f.o.b. Birmingham .....2.00c.
No. 10, f.o.b. cars dock Pacific ports .....2.40c.

Hot-Rolled Annealed

No. 24, f.o.b. Pittsburgh .....2.40c.
No. 24, f.o.b. Gary .....2.50c.
No. 24, del'd Detroit .....2.60c.
No. 24, del'd Phila. .....2.71c.
No. 24, f.o.b. Birmingham .....2.55c.
No. 24, f.o.b. cars dock Pacific ports .....3.05c.
No. 24, wrought iron, Pittsburgh....4.30c.

Heavy Cold-Rolled

No. 10 gage, f.o.b. Pittsburgh .....2.50c.
No. 10 gage, f.o.b. Gary .....2.60c.
No. 10 gage, del'd Detroit .....2.70c.
No. 10, gage, del'd Phila. .....2.81c.
No. 10 gage, f.o.b. Birmingham ....2.65c.
No. 10 gage, f.o.b. cars dock Pacific ports .....3.10c.

Light Cold-Rolled

No. 20 gage, f.o.b. Pittsburgh .....2.95c.
No. 20 gage, f.o.b. Gary .....3.05c.
No. 20 gage, del'd Detroit .....3.15c.
No. 20 gage, del'd Phila .....3.26c.
No. 20 gage, f.o.b. Birmingham ....3.10c.
No. 20 f.o.b. cars dock Pacific ports .....3.50c.

Galvanized Sheets

No. 24 gage, f.o.b. Pittsburgh .....3.10c.
No. 24, f.o.b. Gary .....3.20c.
No. 24, del'd Phila. .....3.41c.
No. 24, f.o.b. Birmingham .....3.25c.
No. 24, f.o.b. cars dock Pacific ports .....3.70c.
No. 24, wrought iron, Pittsburgh...4.95c.

Long Ternes

No. 24, unassorted 8-lb. coating f.o.b. Pittsburgh .....3.40c.
F.o.b. Gary .....3.50c.
F.o.b. cars dock Pacific ports.....4.10c.

Vitreous Enameling Stock

No. 20, f.o.b. Pittsburgh .....3.10c.
No. 20, f.o.b. Gary .....3.20c.
No. 20, f.o.b. Birmingham .....3.70c.
No. 20, f.o.b. cars dock Pacific ports .....3.70c.
No. 10, f.o.b. Pittsburgh .....2.50c.
No. 10, f.o.b. Gary .....2.60c.
No. 10, f.o.b. Birmingham .....3.10c.
No. 10, f.o.b. cars dock Pacific ports .....3.10c.

Tin Mill Black Plate

No. 28, f.o.b. Pittsburgh .....2.75c.
No. 28, Gary .....2.85c.
No. 28, cars dock Pacific Coast ports .....3.35c.

Tin Plate

Per Base Box

Standard cokes, f.o.b. P'gh district mill $5.25
Standard cokes, f.o.b. Gary 5.35
Standard cokes, f.o.b. cars dock Pacific ports 5.90

Terne Plate

(*F.o.b. Pittsburgh*)

(Per Package, 20 x 28 in.)

8-lb. coating I.C. $10.00
15-lb. coating I.C. 12.00
20-lb. coating I.C. 13.00
25-lb. coating I.C. 14.00
30-lb. coating I.C. 15.25
40-lb. coating I.C. 17.50

Hot-Rolled Hoops, Bands, Strips and Flats under ¼ in.

Base per Lb.

All widths up to 24 in., P'gh .....1.85c.
All widths up to 24 in., Chicago ....1.95c.
All widths up to 24 in., del'd Detroit .....2.05c.
All widths up to 24 in., Birmingham .....2.00c.
Cooperage stock, Pittsburgh .....1.95c.
Cooperage stock, Chicago .....2.05c.

Cold-Rolled Strips

Base per Lb.

F.o.b. Pittsburgh .....2.60c.
F.o.b. Cleveland .....2.60c.
Del'd Chicago .....2.825c.
F.o.b. Worcester .....2.80c.

Fender Stock

No. 14, Pittsburgh or Cleveland ....2.50c.
No. 14, Worcester .....3.30c.
No. 20, Pittsburgh or Cleveland ....3.30c.
No. 20, Worcester .....3.70c.

Hot-Rolled Rail Steel Strips

Base per Lb.

F.o.b. Pittsburgh .....1.70c.
F.o.b. Chicago .....1.75c.
F.o.b. Birmingham .....1.85c.

WIRE PRODUCTS

(Carload lots, f.o.b. Pittsburgh and Cleveland.)

To Manufacturing Trade — *Per Lb.*

Bright wire .....2.30c.
Spring wire .....2.90c.

Chicago prices on products sold to the manufacturing trade are $1 a ton above Pittsburgh or Cleveland. Worcester and Duluth prices are $2 a ton above, Birmingham $3 above, and Pacific Coast prices $9 a ton above Pittsburgh or Cleveland.

To Larger Lot Buyers

Base per keg

Standard wire nails $2.40
Smooth coated nails 2.40

Base per 100 Lb.

Annealed fence wire $2.45
Galvanized fence wire 2.80
Polished staples 3.10
Galvanized staples 3.35
Barbed Wire, galvanized 2.80
Twisted barbless wire 2.80
Woven wire fence, base column.....58.00
Single loop bale ties, base column..53.00

Chicago and Anderson, Ind., mill prices are $1 a ton over Pittsburgh base (on all products except woven wire fence, for which the Chicago price is $2 above Pittsburgh); Duluth, Minn., and Worcester, Mass., mill prices are $2 a ton over Pittsburgh (except for woven wire fence at Duluth, which is $3 over Pittsburgh), and Birmingham mill prices are $3 a ton over Pittsburgh.

On wire nails, barbed wire, staples and fence wire, prices at Houston, Galveston and Corpus Christi, Tex., New Orleans, Lake Charles, La., and Mobile, Ala., are $6 a ton over Pittsburgh, while Pacific Coast prices are $8 over Pittsburgh. Exception: on fence wire Pacific Coast prices are $11 a ton above Pittsburgh.

On staples and barbed wire, prices of $6 a ton above Pittsburgh are also quoted at Beaumont and Orange, Tex.

Wire Hoops, Twisted or Welded

Off List

F.o.b. Pittsburgh .....35 and 2½ off
F.o.b. Chicago .....35 off

STEEL AND WROUGHT PIPE AND TUBING

Welded Pipe

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio Mills

F.o.b. Pittsburgh only on wrought iron pipe.

Butt Weld

Steel			*Wrought Iron*		
Inches	Black	Galv.	Inches	Black	Galv.
⅛	51½	29½	⅛	+91½	+138
¼ to ⅜	53½	35	¼ & ⅜	+1½	+21½
½	58½	47	½	31½	15
¾	62	52	¾	36½	20½
1 to 3	64	55	1 & 1¼	39½	25½
			1½	43½	28
			2	41½	26

Lap Weld

2	60	51	2	37	22½
2½ to 3	63	54	2½ to 3½	38	25
3½ to 6	65	56	4 to 8	40	28½
7 and 8	64	54	9 to 12	38	24½
9 and 10	63½	53½			
11 and 12	62½	52½			

Butt Weld, extra strong, plain ends

⅛	48½	33½	⅛	+13	+45½
¼ to ⅜	51	38	¼ & ⅜	+2½	+34½
½	56½	47½	½	32½	17½
¾	61	52	¾	37½	22½
1 to 3	63	55	1 to 2	43½	29

Lap Weld, extra strong, plain ends

2	58	50	2	46	26
2½ to 3	62	54	2½ to 4	45½	32
3½ to 6	65½	57½	4½ to 6	45	33½
7 and 8	64½	54½	7 & 8	46	33
9 and 10	63½	53½	9 to 12	41½	30
11 and 12	62½	52½			

On standard steel pipe an extra 5% off is allowed on sales to consumers while two 5's off apply on sales to jobbers. On less-than-carload shipments prices are determined by adding 20 and 25% and the carload freight rate to the base card. On structural steel pipe the base card is reduced 2 points and two 5's off are allowed to consumers and three 5's off to jobbers.

Note—Chicago district mills have a base two points less than the above discounts. Chicago delivered base is 2½ points less. Freight is figured from Pittsburgh, Lorain, Ohio, and Chicago district mills, the billing being from the point producing the lowest price to destination.

Boiler Tubes

Seamless Steel Commercial Boiler Tubes and Locomotive Tubes

(Net base prices per 100 ft. f.o.b. Pittsburgh in carload lots)

		Cold Drawn	Hot Rolled
1 in. o.d.	13 B.W.G.	$ 8.60	$ 7.52
1¼ in. o.d.	13 B.W.G.	10.19	9.26
1½ in. o.d.	13 B.W.G.	11.26	10.23
1¾ in. o.d.	13 B.W.G.	12.31	11.64
2 in. o.d.	13 B.W.G.	14.35	13.04
2¼ in. o.d.	13 B.W.G.	16.00	14.54
2½ in. o.d.	12 B.W.G.	17.61	16.01
2¾ in. o.d.	12 B.W.G.	19.29	17.54
2¾ in. o.d.	12 B.W.G.	20.45	18.59
3 in. o.d.	12 B.W.G.	21.45	19.50
3½ in. o.d.	10 B.W.G.	41.08	37.35
3¾ in. o.d.	11 B.W.G.	37.99	34.62
4 in. o.d.	10 B.W.G.	33.60	30.54
4½ in. o.d.	10 B.W.G.	41.08	37.35
5 in. o.d.	9 B.W.G.	51.56	46.87
6 in. o.d.	7 B.W.G.	79.15	71.90

Extras for less-carload quantities:

25,000 lb. or ft. to 39,999 lb. or ft. 5 %
12,000 lb. or ft. to 24,999 lb. or ft. 12½ %
6,000 lb. or ft. to 11,999 lb. or ft. 25 %
2,000 lb. or ft. to 5,999 lb. or ft. 35 %
Under 2,000 lb. or ft. 50 %

Lapweld Steel and Knobbled Charcoal Iron Pressure Tubes

(Net base prices per 100 ft. f.o.b. Pittsburgh, in carload lots)

		Steel	*Iron*
1½ in. o.d.	13 B.W.G.	$ 9.72	$20.16
1¾ in. o.d.	13 B.W.G.	11.06	21.84
2 in. o.d.	13 B.W.G.	12.33	17.23
2¼ in. o.d.	13 B.W.G.	13.79	19.58
2½ in. o.d.	12 B.W.G.	16.58	24.19
2¾ in. o.d.	12 W.B.G.	17.54	26.40
3 in. o.d.	12 B.W.G.	18.35	28.39
3¼ in. o.d.	11 B.W.G.	21.56	33.95
3½ in. o.d.	11 B.W.G.	23.15	36.16
4 in. o.d.	10 B.W.G.	28.66	45.26
4½ in. o.d.	10 B.W.G.	35.22	50.48
5 in. o.d.	9 B.W.G.	44.25	61.86
6 in. o.d.	7 B.W.G.	68.14	102.46

Quantity Extras:

40,000 lb. or ft. .....base
25,000 lb. or ft. to 39,999 lb. or ft. .....plus 5%
10,000 lb. or ft. to 24,999 lb. or ft. .....plus 12½ %
2,000 lb. or ft. to 9,999 lb. or ft. .....plus 25%
Under 2,000 lb. or ft .....plus 40%

CAST IRON WATER PIPE

Per Net Ton

*6-in. and larger, del'd Chicago....$48.40
*4-in., del'd Chicago 51.40
6-in. and larger, del'd New York.. 45.20
4-in., del'd New York 48.20
*6-in. and larger, Birmingham..... 40.00
*4-in. Birmingham 43.00
6-in. and larger, f.o.b. dock, San Francisco or Los Angeles 48.00
F.o.b. dock, Seattle 48.50
4-in., f.o.b. dock, San Francisco or Los Angeles 51.00
F.o.b. dock, Seattle..... 51.50

Class "A" and gas pipe, $3 extra.

*Prices for lots of less than 200 tons. For 200 tons and over, 6-in. and larger is $39, Birmingham, and $47.40, delivered Chicago, and 4-in. pipe, $42, Birmingham, and $50.40 a ton, delivered Chicago.

RAILROAD MATERIALS

Rails and Track Supplies

F.o.b. Mill

Standard rails, heavier than 60 lb. per gross ton $36.37½
Angle bars, per 100 lb. 2.55

F.o.b. Code Basing Points

Light rails (from billets) per gross ton $35.00
Light rails (from rail steel) per gross ton 34.00

Base per 100 Lb.

Spikes, 9/16 in. and larger $2.40
Spikes, ½ and smaller 2.40
Tie plates, steel 1.90
Tie plates, Pacific Coast ports..... 2.00
Track bolts, to steam railroads..... 3.55
Track bo'ts, no jobbers, all sizes (per 100 count) .....70 per cent off list

Basing points on light rails are Pittsburgh, Chicago and Birmingham; on spikes and tie plates, Pittsburgh, Chicago, Buffalo, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Birmingham and Pacific Coast ports; on tie plates alone, Steelton, Pa.; on spikes alone, Cleveland, Youngstown, Lebanon, Pa., Columbia, Pa., Richmond, Va.

BOLTS, NUTS, RIVETS AND SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

	Per Cent Off List
Machine bolts	75
Carriage bolts	75
Lag bolts	75
Plow bolts, Nos. 1, 2, 3 and 7 heads	75
Hot-pressed nuts, blank or tapped, square	75
Hot-pressed nuts, blank or tapped, hexagon	75
C.p.c. and t. square or hex. nuts, blank or tapped	75
Semi-finished hexagon nuts, U.S.S. and S.A.E., all sizes to and incl. 1 in. diameter	75
Larger than 1 in. diameter	75
Stove bolts in packages, Pittsburgh	75
Stove bolts in packages, Chicago	75
Stove bolts in packages, Cleveland	75
Stove bolts in bulk, Pittsburgh	88
Stove bolts in bulk, Chicago	88
Stove bolts in bulk, Cleveland	83
Tire bolts	60

Large Rivets

(½-in. and larger)

	Base per 100 Lb.
F.o.b. Pittsburgh or Cleveland	$2.90
F.o.b. Chicago	3.00
F.o.b. Birmingham	3.05

Small Rivets

(7/16-in. and smaller)

	Per Cent Off List
F.o.b. Pittsburgh	70 and 5
F.o.b. Cleveland	70 and 5
F.o.b. Chicago and Birm'g'm	70 and 5

Cap and Set Screws

(Freight allowed up to but not exceeding 65c. per 100 lb. on lots of 200 lb. or more)

	Per Cent Off List
Milled cap screws, 1 in. dia. and smaller	80, 10 and 10
Milled standard set screws, case hardened, 1 in. dia. and smaller	75
Milled headless set screws, cut thread ⅝ in. and smaller	75
Upset hex. head cap screws, U.S.S. or S.A.E. thread, 1 in. dia and smaller	85
Upset set screws, cut and oval points	75 and 10
Milled studs	65 to 65 and 10

Alloy and Stainless Steel

Alloy Steel Ingots

F.o.b. Pittsburgh, Chicago, Canton, Massillon, Buffalo, Bethlehem. Uncropped ..... $40 per gross ton

Alloy Steel Blooms, Billets and Slabs

F.o.b. Pittsburgh, Chicago, Canton, Massillon, Buffalo, Bethlehem. Base price, $49 a gross ton.

Alloy Steel Bars

Price del'd Detroit is $52.

F.o.b. Pittsburgh, Chicago, Buffalo, Bethlehem, Massillon or Canton.

Open-hearth grade, base	2.45c.
Delivered price at Detroit is	2.60c.

S.A.E. Series Numbers	Alloy Differential per 100 lb.
2000 (1½% Nickel)	$0.25
2100 (2½% Nickel)	0.55
2300 (3½% Nickel)	1.50
2500 (5% Nickel)	2.25
3100 Nickel Chromium	0.55
3200 Nickel Chromium	1.35
3300 Nickel Chromium	3.80
3400 Nickel Chromium	3.20
4100 Chromium Molybdenum (0.15 to 0.25 Molybdenum)	0.50
4100 Chromium Molybdenum (0.25 to 0.40 Molybdenum)	0.70
4600 Nickel Molybdenum (0.20 to 0.30 Molybdenum) (1.50 to 2.00 Nickel)	1.05
5100 Chromium Steel (0.60 to 0.90 Chromium)	0.35
5100 Chromium Steel (0.80 to 1.10 Chromium)	0.45
5100 Chromium Spring Steel	base
6100 Chromium Vanadium Bar	1.30
6100 Chromium Vanadium Spring Steel	0.70
Chromium Nickel Vanadium	1.50
Carbon Vanadium	0.95

These prices are for hot-rolled steel bars. The differential for most grades in electric furnace steel is 50c. higher. The differential for cold-drawn bars ½c. per lb. higher with separate extras. Blooms, billets and slabs under 4x4 in. or equivalent are sold on the bar base. Slabs with a section area of 16 in. and 2½ in. thick or over take the billet base. Sections 4x4 in. to 10x10 in. or equivalent carry a gross ton price, which is the net price for bars for the same analysis. Larger sizes carry extras.

Alloy Cold-Finished Bars

F.o.b. Pittsburgh, Chicago, Gary, Cleveland or Buffalo. 2.95c. base per lb.

STAINLESS STEEL No. 302

(17 to 19% Cr. 7 to 9% NI. 0.08 to 0.20% C.)

(Base Prices f.o.b. Pittsburgh)

	Per Lb.
Forging billets	19.55c.
Rerolling slabs	15c.
Bars	23c.
Plates	26c.
Structural shapes	23c.
Sheets	33c.
Hot-rolled strip	20¾c.
Cold-rolled strip	27c.
Drawn wire	23c.

Raw and Semi-Finished Steel

Carbon Steel Rerolling Ingots

F.o.b. Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham. Uncropped ..... $29 per gross ton

Carbon Steel Forging Ingots

F.o.b. Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Birmingham. Uncropped ..... $31 per gross ton

Billets, Blooms and Slabs

F.o.b. Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham.

	Per Gross Ton
Rerolling	$27.00
Forging quality	35.00

Delivered Detroit

Rerolling	$30.00
Forging	38.00

Billets Only F.o.b. Duluth

Rerolling	$29.00
Forging	37.00

Sheet Bars

F.o.b. Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

	Per Gross Ton
Open-hearth or Bessemer	$38.00

Skelp

F.o.b. Pittsburgh, Chicago, Youngstown, Buffalo, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved	1.70c.
Universal	1.70c.
Sheared	1.70c.

Wire Rods

(Common, base)

	Per Gross Ton
F.o.b. Pittsburgh	$38.00
F.o.b. Cleveland	38.00
F.o.b. Chicago	39.00
F.o.b. Anderson, Ind.	39.00
F.o.b. Youngstown	39.00
F.o.b. Worcester, Mass.	40.00
F.o.b. Birmingham	41.00
F.o.b. San Francisco	47.00
F.o.b. Galveston	44.00

Pig Iron and Ferroalloys

PIG IRON

PRICES PER GROSS TON AT BASING POINTS

Basing Points	No. 2 Fdry.	Malleable	Basic	Bessemer
Everett, Mass.	$19.50	$20.00	$19.00	$20.50
Bethlehem, Pa.	19.50	20.00	19.00	20.50
Birdsboro, Pa.	19.50	20.00	19.00	20.50
Swedeland, Pa.	19.50	20.00	19.00	20.50
Steelton, Pa.	....	....	19.00	....
Sparrows Point, Md.	19.50	....	19.00	....
Neville Island, Pa.	18.50	18.50	18.00	19.00
Sharpsville, Pa.	18.50	18.50	18.00	19.00
Youngstown	18.50	18.50	18.00	19.00
Buffalo	18.50	19.00	17.50	19.50
Erie, Pa.	18.50	19.00	18.00	19.50
Cleveland	18.50	18.50	18.00	19.00
Toledo, Ohio	18.50	18.50	18.00	19.00
Jackson, Ohio	20.25	19.75	18.75	20.75
Detroit	18.50	18.50	18.00	19.00
Hamilton, Ohio	18.50	18.50	18.00	19.00
Chicago	18.50	18.50	18.00	19.00
Granite City, Ill.	18.50	18.50	18.00	....
Duluth, Minn.	19.00	19.00	....	19.50
Birmingham	14.50	14.50	13.50	19.00
Provo, Utah	17.50	....	17.00	....

DELIVERED PRICES PER GROSS TON AT CONSUMING CENTERS

	No. 2 Fdry.	Malleable	Basic	Bessemer
Boston Switching District From Everett, Mass.	$20.00	$20.50	$19.50	$21.00
Brooklyn From East, Pa.	21.9289	22.4289	21.9289	22.9289
Newark or Jersey City, N. J. From East, Pa.	20.9873	21.4873	20.4873	21.9873
Philadelphia From Eastern Pa.	20.3132	20.8132	19.8132	21.3132
Cincinnati From Hamilton, Ohio	19.5807	19.5807	19.0807	20.0807
Canton, Ohio From Cleveland and Youngstown	19.8402	19.8402	19.3402	20.3402
Columbus, Ohio From Hamilton, Ohio	20.64	20.64	....	....
Mansfield, Ohio From Cleveland and Toledo	20.3832	20.3832	....	....
Indianapolis From Hamilton, Ohio	20.9289	20.9289	....	....
South Bend, Ind. From Chicago	20.6935	20.6935	....	....
Milwaukee From Chicago	19.57	19.57	....	....
St. Paul From Duluth	20.94	....	....	....
Davenport, Iowa From Chicago	20.3832	20.3832	....	....
Kansas City From Granite City	21.2178	21.2178	....	....
San Francisco, Los Angeles or Seattle. From Provo	22.315	....	....	....

Delivered prices on Southern iron for shipment to Northern points are 38c. a gross ton below delivered prices from the nearest Northern basing points.

LOW PHOSPHORUS PIG IRON

Basing points: Birdsboro, Pa., Steelton, Pa., and Standish, N. Y. $23.50

GRAY FORGE PIG IRON

Valley furnace	$18.00
Pittsburgh district furnace	18.00

CHARCOAL PIG IRON

Lake Superior furnace	$21.50
Delivered Chicago	24.7528
Delivered Buffalo	25.095

CANADA

Pig Iron

Per gross ton:

Delivered Toronto

No. 1 fdy., sil. 2.25 to 2.75	$21.00
No. 2 fdy., sil. 1.75 to 2.75	20.50
Malleable	21.00

Delivered Montreal

No. 1 fdy., sil. 2.25 to 2.75	$22.50
No. 2 fdy., sil. 1.75 to 2.25	22.00
Malleable	22.50
Basic	22.00

FERROALLOYS

Ferromanganese

F.o.b. New York, Philadelphia, Baltimore, Mobile or New Orleans.

	Per Gross Ton
Domestic, 80% (carload)	$85.00

Spiegeleisen

	Per Gross Ton Furnace
Domestic, 19 to 21%	$26.00
50-ton lots 3-mo. shipment	24.00
F.o.b. New Orleans	26.00

Electric Ferrosilicon

		Per Gross Ton Delivered
50%	(carloads)	$77.50
50%	(ton lots)	85.00
75%	(carloads)	126.00
75%	(ton lots)	136.00

Silvery Iron

F.o.b. Jackson, Ohio, Furnace

Per Gross Ton		*Per Gross Ton*	
6%	$32.75	13%	$39.25
7%	32.75	14%	39.75
8%	34.75	14½%	32.25
9%	35.75	15%	33.75
10%	26.75	16%	35.25
11%	27.75	17%	36.75

The lower all-rail delivered price from Jackson or Buffalo is quoted with freight allowed. Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Manganese 2 to 3%, $1 a ton additional. For each unit of manganese over 3%, $1 a ton additional.

Bessemer Ferrosilicon

F.o.b. Jackson, Ohio, Furnace

Per Gross Ton		*Per Gross Ton*	
10%	$27.75	14%	$33.25
11%	28.75	15%	34.75
12%	30.25	16%	36.25
13%	31.75	17%	37.75

Manganese 2 to 3%, $1 a ton additional. For each unit of manganese over 3%, $1 a ton additional. Phosphorus 0.75% or over, $1 ton additional.

Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Other Ferroalloys

Ferrotungsten, per lb. contained W. del., carloads	$1.35 to $1.45
Ferrotungsten, less carloads	1.45 to 1.55
Ferrochromium, 4 to 6% carbon and up, 65 to 70% Cr. per lb. contained Cr. delivered, in carloads	10.00c.
Ferrochromium, 2% carbon	16.50c. to 17.00c.
Ferrochromium, 1% carbon	17.50c. to 18.00c.
Ferrochromium, 0.10% carbon	19.50c. to 20.00c.
Ferrochromium, 0.06% carbon	20.00c. to 20.50c.
Ferrovanadium, del. per lb. contained V.	$2.70 to $2.90
Ferrocarbontitanium, 15 to 18% Ti, 6 to 8% C. f.o.b. furnace carload and contract per net ton	$137.50
Ferrophosphorus, electric, or blast furnace material, in carloads, 18%, Rockdale, Tenn., base, per gross ton with $2 unitage	50.00
Ferrophosphorus, electric, 24%, f.o.b. Anniston, Ala., per gross ton with $2.75 unitage	65.00
Ferromolybdenum, per lb. Mo., del.	95c.
Calcium molybdate, per lb. Mo., del.	80c.
Silico spiegel, per ton, f.o.b. furnace, carloads	$38.00
Ton lots or less, per ton	45.50
Silico-manganese, gross ton, delivered. 2.50% carbon grade	90.00
2% carbon grade	95.00
1% carbon grade	105.00
Spot prices	$5 a ton higher

Iron and Steel Scrap

PITTSBURGH

Per gross ton delivered consumers' yards:

No. 1 heavy melting steel	$13.25 to $13.75
No. 2 heavy melting steel	12.00 to 12.50
No. 3 railroad wrought	13.50 to 14.00
Scrap rails	14.25 to 14.75
Rails, 3 ft. and under	15.50 to 16.00
Compressed sheet steel	13.25 to 13.75
Hand bundled sheet steel	12.00 to 12.50
Hvy. steel axle turnings	11.50 to 12.00
Machine shop turnings	9.50 to 10.00
Short shov. turnings	9.50 to 10.00
Short mixed borings and turnings	8.00 to 8.50
Cast iron borings	8.00 to 8.50
Cast iron carwheels	14.00 to 14.50
Heavy breakable cast	12.25 to 12.75
No. 1 cast	14.00 to 14.50
Railr. knuckles and couplers	15.00 to 15.50
Rail. coil and leaf springs	15.50 to 16.00
Rolled steel wheels	15.50 to 16.00
Low. phos. billet crops	16.50 to 17.00
Low phos. sheet bar crops	15.50 to 16.00
Low phos. punchings	15.00 to 15.50
Low phos. plate scrap	14.50 to 15.00
Steel car axles	14.50 to 15.00

CHICAGO

Delivered Chicago district consumers:

	Per Gross Ton
Heavy melting steel	$12.25 to $12.75
Automobile hvy. melt. steel	11.25 to 11.75
Shoveling steel	12.25 to 12.75
Hydraulic comp. sheets	11.25 to 11.75
Drop forge flashings	9.50 to 10.00
No. 1 busheling	11.00 to 11.50
Rolled carwheels	12.75 to 13.25
Railroad tires	13.00 to 13.50
Railroad leaf springs	12.75 to 13.25
Axle turnings	11.00 to 11.50
Steel couplers and knuckles	13.25 to 13.75
Coil springs	14.25 to 14.75
Axle turnings (elec. fur.)	11.75 to 12.25
Low phos. punchings	14.50 to 15.00
Low phos. plates, 12 in. and under	14.50 to 15.00
Cast iron borings	6.00 to 6.50
Short shoveling turnings	7.50 to 8.00
Machine shop turnings	7.00 to 7.50
Rerolling rails	13.50 to 14.00
Steel rails, less than 3 ft.	13.50 to 14.00
Steel rails, less than 2 ft.	15.00 to 15.50
Angle bars, steel	14.00 to 14.50
Cast iron carwheels	12.75 to 13.25
Railroad malleable	14.75 to 15.25
Agricultural malleable	10.25 to 10.75

	Per Net Ton
Iron car axles	$15.50 to $16.00
Steel car axles	14.75 to 15.25
No. 1 railroad wrought	9.50 to 10.00
No. 2 railroad wrought	11.00 to 11.50
No. 2 busheling	6.50 to 7.00
Locomotive tires, smooth	11.50 to 12.00
Pipes and flues	7.00 to 7.50
No. 1 machinery cast	11.25 to 11.75
Clean automobile cast	10.50 to 11.00
No. 1 railroad cast	9.75 to 10.25
No. 1 agricultural cast	10.00 to 10.50
Stove plate	8.00 to 8.50
Grate bars	8.00 to 8.50
Brake shoes	8.00 to 8.50

PHILADELPHIA

Per gross ton delivered consumers' yards:

No. 1 heavy melting steel	$12.00
No. 2 heavy melting steel	$11.00 to 11.50
Hydraulic compressed, new	10.00 to 10.50
Hydraulic compressed, old	8.50 to 9.00
Steel rails for rolling	14.00 to 14.50
Cast iron carwheels	12.50 to 13.00
Heavy breakable cast	11.00 to 11.50
No. 1 cast	11.50 to 12.00
Stove plate (steel works)	9.00 to 9.50
Machine shop turnings	7.50 to 8.00
No. 1 blast furnace	5.50 to 6.00
Heavy axle turnings	9.50 to 10.00
Cast borings	5.00 to 5.50
No. 1 low phos. heavy	14.50 to 15.00
Couplers and knuckles	14.00 to 14.50
Rolled steel wheels	14.00 to 14.50
Steel axles	16.00 to 16.50
Shafting	18.00 to 18.50
No. 1 railroad wrought	12.00 to 12.50
Spec. iron and steel pipe	9.50 to 10.00
Bundled sheets	9.50 to 10.00
No. 1 forge fire	9.50 to 10.00
Cast borings (chem.)	10.50 to 13.00

CINCINNATI

Dealers' buying prices per gross ton:

No. 1 heavy melting steel	$10.00 to $10.50
No. 2 heavy melting steel	8.00 to 8.50
Scrap rails for melting	9.25 to 9.75
Loose sheet clippings	6.00 to 6.50
Bundled sheets	7.25 to 7.75
Cast iron borings	5.50 to 6.00
Machine shop turnings	5.75 to 6.25
No. 1 busheling	7.25 to 7.75
No. 2 busheling	3.75 to 4.25
Rails for rolling	10.25 to 10.75
No. 1 locomotive tires	8.50 to 9.00
Short rails	13.00 to 13.50
Cast iron carwheels	9.50 to 10.00
No. 1 machinery cast	10.50 to 11.00
No. 1 railroad cast	9.75 to 10.25
Burnt cast	7.25 to 7.75
Stove plate	7.25 to 7.75
Agricultural malleable	9.25 to 9.75
Railroad malleable	10.50 to 11.00

CLEVELAND

Per gross ton delivered consumers' yards:

No. 1 heavy melting steel	$12.25 to $12.50
No. 2 heavy melting steel	11.25 to 11.50
Compressed sheet steel	11.00 to 11.50
Light bundled sheet stampings	9.25 to 9.75
Drop forge flashings	10.50 to 11.00
Machine shop turnings	7.75 to 8.25
Short shoveling turnings	8.00 to 8.50
No. 1 busheling	10.50 to 11.00
Steel axle turnings	10.50 to 11.00
Low phos. billet crops	15.00 to 15.50
Cast iron borings	7.75 to 8.25
Mixed borings and short turnings	7.75 to 8.25
No. 2 busheling	7.75 to 8.25
No. 1 cast	13.50 to 14.00
Railroad grate bars	7.00 to 7.50
Stove plate	7.50 to 8.00
Rails under 3 ft.	13.00 to 13.50
Rails for rolling	15.50 to 16.00
Railroad malleable	15.50 to 16.00
Cast iron carwheels	10.75 to 11.00

BUFFALO

Per gross ton, f.o.b. Buffalo consumers' plants:

No. 1 heavy melting steel	$12.00 to $12.50
No. 2 heavy melting scrap	11.00 to 11.50
Scrap rails	12.00 to 12.50
New hydraul. comp. sheets	11.00 to 11.50
Old hydraul. comp. sheets	9.50 to 10.00
Drop forge flashings	10.50 to 11.00
No. 1 busheling	11.00 to 11.50
Hvy. steel axle turnings	10.50 to 11.00
Machine shop turnings	5.50 to 6.00
Knuckles and couplers	13.00 to 14.00
Coil and leaf springs	13.00 to 14.00
Rolled steel wheels	13.00 to 14.00
Low phos. billet crops	14.50 to 15.00
Short shov. steel turnings	7.50 to 8.00
Short mixed borings and turnings	7.50 to 8.00
Cast iron borings	7.50 to 8.00
No. 2 busheling	7.00 to 7.50
Steel car axles	12.50 to 13.00
Iron axles	12.50 to 13.00
No. 1 machinery cast	12.50 to 13.00
No. 1 cupola cast	11.50 to 12.00
Stove plate	10.00 to 10.50
Steel rails, 3 ft. and under	14.50 to 15.00
Cast iron carwheels	12.00 to 12.50
Railroad malleable	14.00 to 14.50
Chemical borings	9.00 to 9.50

BOSTON

Dealers' buying prices per gross ton:

*No. 1 heavy melting steel	$9.00 to $9.25
No. 1 heavy melting steel	7.40 to 7.90
*Scrap rails	9.25 to 9.50
Scrap rails	7.50 to 8.00
*No. 2 steel	8.00 to 8.25
No. 2 steel	6.40 to 6.90
Breakable cast	6.00 to 6.25
Machine shop turnings	.... 3.65
Bundled skeleton, long	.... 6.15
Forge flashings	.... 6.15
Shafting	13.00 to 13.25
Steel car axles	12.50 to 13.00
Cast iron borings, chemical	5.00 to 7.00

Per gross ton delivered consumers' yards:

Textile cast	$9.50 to $10.00
No. 1 machinery cast	9.50 to 10.00
Stove plate	6.00 to 6.50
Railroad malleable	11.00 to 11.50

* Delivered local army base.

NEW YORK

Dealers' buying prices per gross ton:

No. 1 heavy melting steel	$8.50 to $8.75*
No. 2 heavy melting steel	7.50 to 7.75*
Heavy breakable cast	6.75 to 7.25
No. 1 machinery cast	7.00 to 7.50
No. 2 cast	.... †6.50
Stove plate	.... †6.50
Steel car axles	13.50 to 14.00
Shafting	13.50 to 13.75
No. 1 railroad wrought	7.75 to 8.25
No. 1 yard wrought, long	6.75 to 7.25
Spec. iron and steel pipe	5.50 to 6.00
Forge fire	6.50 to 7.00
Rails for rolling	9.00 to 10.00
Short shoveling turnings	3.00 to 3.25
Machine shop turnings	3.50 to 4.00
Cast borings	3.50 to 3.75
No. 1 blast furnace	2.00 to 2.50
Cast borings (chemical)	11.00 to 11.50
Unprepared yard iron and steel	4.50 to 5.00

Per gross ton, delivered local foundries:

No. 1 machinery cast	.... $10.50
No. 1 hvy. cast (cupola size)	.... 9.50
No. 2 cast	.... 8.00

† Loading on barge.
*25c. higher offered to nearby New Jersey points.

BIRMINGHAM

Per gross ton delivered consumers' yards:

Heavy melting steel	$7.50 to $8.00
Scrap steel rails	10.00 to 10.50
Short shoveling turnings	.... 7.00
Stove plates	.... 7.00
Steel axles	.... 11.50
Iron axles	.... 11.50
No. 1 railroad wrought	.... 7.00
Rails for rolling	.... 12.50
No. 1 cast	10.00 to 10.50
Tramcar wheels	.... 10.00

ST. LOUIS

Per gross ton delivered consumers' yards:

Selected heavy steel	$10.50 to $11.00
No. 1 heavy melting	10.00 to 10.50
No. 2 heavy melting	8.00 to 8.50
No. 1 locomotive tires	9.75 to 10.25
Misc. stand-sec. rails	11.00 to 11.50
Railroad springs	12.00 to 12.50
Bundled sheets	6.50 to 7.00
No. 2 railroad wrought	10.00 to 10.50
No. 1 busheling	5.00 to 5.50
Cast iron borings and shoveling turnings	3.00 to 3.50
Rails for rolling	11.50 to 12.00
Machine shop turnings	2.75 to 3.25
Heavy turnings	5.50 to 6.00
Steel car axles	13.50 to 13.00
Iron car axles	15.00 to 16.00
No. 1 railroad wrought	7.00 to 7.50
Steel rails less than 3 ft.	13.00 to 13.50
Steel angle bars	12.00 to 12.50
Cast iron carwheels	9.00 to 9.50
No. 1 machinery cast	9.50 to 10.00
Railroad malleable	12.50 to 13.00
No. 1 railroad cast	9.00 to 9.50
Stove plate	6.50 to 7.00
Agricult. malleable	8.50 to 9.00

DETROIT

Dealers' buying prices per gross ton:

Heavy melting steel	$9.50 to $10.00
Borings and short turnings	5.75 to 6.25
Long turnings	$5.75 to $6.25
No. 1 machinery cast	12.50 to 13.00
Automotive cast	13.00 to 13.50
Hydraulic comp. sheets	10.25 to 10.75
Stove plate	7.75 to 8.25
New factory busheling	9.00 to 9.50
Old No. 2 busheling	5.25 to 5.75
Sheet clippings	7.00 to 7.50
Flashings	8.50 to 9.00
Low phos. plate scrap	10.25 to 10.75

CANADA

Dealers' buying prices per gross ton:

	Toronto	Montreal
Heavy melting steel	$8.00	$7.50
Rails, scrap	8.50	8.00
Machine shop turnings	3.50	3.50
Boiler plate	5.00	5.00
Heavy axle turnings	4.50	4.00
Cast borings	4.50	4.00
Steel borings	3.00	3.00
Wrought pipe	4.00	4.00
Steel axles	8.00	8.50
Axles, wrought iron	8.00	8.50
No. 1 machinery cast	9.50	9.00
Stove plate	6.50	6.00
Standard carwheels	7.75	7.00
Malleable	7.50	7.00

ORES, FLUORSPAR, COKE, FUEL, REFRACTORIES

Lake Superior Ores

Delivered Lower Lake Ports

	Per Gross Ton
Old range, Bessemer, 51.50% iron	$4.80
Old range, non-Bessemer, 51.50% iron	4.65
Mesabi, Bessemer, 51.50% iron	4.65
Mesabi, non-Bessemer, 51.50% iron	.50
High phosphorus, 51.50% iron	4.40

Foreign Ore

C.i.f. Philadelphia or Baltimore

	Per Unit
Iron, low phos., copper free, 55 to 58% iron, dry Spanish or Algeria	10.50c.
Iron, low phos., Swedish, average 68½% iron	10.50c.
Iron, basic or foundry, Swedish, aver. 65% iron	9.50c.
Iron, basic or foundry, Russian, aver. 65% iron	9.50c.
Manganese, Caucasian, washed 52%	26c.
Manganese, African, Indian, 44-48%	22c.
Manganese, African, Indian, 49-51%	24c.
Manganese, Brazilian, 46 to 48½%	20c.

	Per Net Ton Unit
Tungsten, Chinese, wolframite, duty paid, delivered	$15.50 to $16.00
Tungsten, domestic, scheelite, delivered	15.00

	Per Gross Ton
Chrome, 45% Cr_2O_3, lump, c.i.f. Atlantic Seaboard (African)	$17.50
45 to 46% Cr_2O_3 (Turkish)	$16.00 to 16.50
48% Cr_2O_3 (African)	20.50
48% min. Cr_2O_3 (Turkish)	19.25
Chrome concentrate, 50% and over Cr_2O_3, c.i.f. Atlantic Seaboard	22.00
52% Cr_2O_3 (Turkish)	21.75
48 to 49% Cr_2O_3 (Turkish)	19.25

Fluorspar

	Per Net Ton
Domestic, washed gravel, 85-5, f.o.b. Kentucky and Illinois mines for all-rail shipment	$14.00 to $15.00
Same grade for Ohio River barge shipment for Kentucky and Illinois River landings	15.00
No. 2 lump, 85-5, f.o.b. Kentucky and Illinois mines	14.00 to 15.00
Foreign, 85% calcium fluoride, not over 5% silicon, c.i.f. Atlantic ports, duty paid	18.50
Domestic, No. 1 ground bulk, 95 to 98% calcium fluoride, not over 2½% silicon, f.o.b. Illinois and Kentucky mines	30.00

COKE, COAL AND FUEL OIL

Coke

	Per Net Ton
Furnace, f.o.b. Connellsville Prompt	$3.60 to $3.75
Foundry, f.o.b. Connellsville Prompt	4.25 to 5.75
Foundry, by-product, Chicago ovens, for delivery outside switching district	9.00
Foundry, by-product, delivered in Chicago switching district	9.75
Foundry, by-product, New England, delivered	11.00
Foundry, by-product, Newark or Jersey City, del'd	9.24 to 9.72
Foundry, by-product, Phila.	9.03
Foundry, by-product, Cleveland, delivered	9.75
Foundry, Birmingham	6.00
Foundry, by-product, St. Louis, f.o.b. ovens	$8.00
Foundry, by-product, del'd St. Louis	9.00
Foundry, from Birmingham, f.o.b. cars docks, Pacific ports	14.75

Coal

	Per Net Ton
Mine run steam coal, f.o.b. W. Pa. mines	$1.60 to $1.80
Mine run coking coal, f.o.b. W. Pa.	1.90 to 2.10
Gas coal, ¾-in., f.o.b. Pa. mines	2.00 to 2.50
Mine run gas coal, f.o.b. Pa. mines	1.90 to 2.10
Steam slack, f.o.b. W. Pa. mines	1.15 to 1.40
Gas slack, f.o.b. W. Pa. mines	1.35 to 1.60

Fuel Oil

	Per Gal. f.o.b. Bayonne, N. J.
No. 3 distillate	4.35c.
No. 4 industrial	3.87½c.

	Per Gal. f.o.b. Baltimore
No. 3 distillate	4.25c.
No. 4 industrial	3.87½c.

	Per Gal. del'd Chicago
No. 3 industrial fuel oil	4.75c.
No. 5 industrial fuel oil	3.75c.

	Per Gal. f.o.b. Cleveland
No. 3 distillate	5.25c.
No. 4 industrial	5.13½c.
No. 5 industrial	4.00c

REFRACTORIES

Fire Clay Brick

	Per 1000 f.o.b. Works High-heat Duty Brick	Intermediate Duty Brick
Pennsylvania	$45.00	$40.00
Maryland	5.00	40.00
New Jersey	50.00	43.00
Ohio	45.00	40.00
Kentucky	45.00	40.00
Missouri	45.00	40.00
Illinois	45.00	40.00
Ground fire clay, per ton	7.00	

Silica Brick

	Per 1000 f.o.b. Works
Pennsylvania	$45.00
Chicago District	54.00
Birmingham	55.00
Silica clay, per net ton	8.00

Chrome Brick

	Per Net Ton
Standard, f.o.b. Baltimore, Plymouth Meeting and Chester, Pa.	$45.00
Chemically bonded, f.o.b. Baltimore, Plymouth Meeting and Chester, Pa.	45.00

Magnesite Brick

	Per Net Ton
Standard, f.o.b. Baltimore and Chester, Pa.	$65.00
Chemically bonded, f.o.b. Baltimore	55.00

Grain Magnesite

	Per Net Ton
Imported, f.o.b. Baltimore and Chester, Pa.	$45.00
Domestic, f.o.b. Baltimore and Chester	40.00
Domestic, f.o.b. Chewelah, Wash.	32.00

Warehouse Prices for Steel Products

PITTSBURGH

Base per Lb.

Plates	3.15c.
Structural shapes	3.15c.
Soft steel bars and small shapes	2.95c.
Reinforcing steel bars	2.90c.
Cold-finished and screw stock:	
Rounds and hexagons	3.20c.
Squares and flats	3.20c.
Heops and bands under ¼ in.	3.20c.
Hot-rolled annealed sheets (No. 24), 25 or more bundles	3.30c.
Galv. sheets (No. 24), 25 or more bundles	3.95c.
Hot-rolled sheets (No. 10)	2.95c.
Galv. corrug. sheets (No. 28), per square (more than 3750 lb.)	$3.69
Spikes, large	2.90c.
Track bolts, all sizes, per 100 count, 65 per cent off list.	
Machine bolts, 100 count, 65 per cent off list.	
Carriage bolts, 100 count, 65 per cent off list.	
Nuts, all styles, 100 count, 65 per cent off list.	
Large rivets, base per 100 lb.	$3.50
Wire, black, soft ann'l'd, base per 100 Lb	*2.70
Wire, galv. soft, base per 100 lb.	*2.925
Common wire nails, per keg	*2.834
Cement coated nails, per keg	*2.834

On plates, structurals, bars, reinforcing bars, bands, hoops and blue annealed sheets, base applies to orders of 400 to 9999 lbs.

*Delivered in Pittsburgh switching district.

CHICAGO

Base per Lb.

Plates and structural shapes	3.20c.
Soft steel bars	2.95c.
Cold-fin. steel bars:	
Rounds and hexagons	3.35c.
Flats and squares	3.35c.
Hot-rolled strip	3.30c.
Hot-rolled annealed sheets (No. 24)	3.85c.
Galv. sheets (No. 24)	4.55c.
Hot-rolled sheets (No. 10)	3.05c.
Spikes (keg lots)	3.50c.
Track bolts (keg lots)	4.65c.
Rivets, structural (keg lots)	3.65c.
Rivets, boiler (keg lots)	3.75c.

Per Cent Off List

Machine bolts	*70
Carriage bolts	*70
Lag screws	*70
Hot-pressed nuts, sq. tap. or	
Hot-pressed nuts, sq. tap or blank	*70
Hot-pressed nuts, hex. tap or	
Hot-pressed nuts, hex. tap or blank	*70
Hex. head cap screws	87½
Cut point set screws	80
Flat head bright wood screws..50 and	20
Spring cotters	55
Stove bolts in full packages	70
Rd. hd. tank rivets, 7/16 in. and smaller	57½
Wrought washers	$4.50 off list
Black ann'l'd wire per 100 lb.	$3.85
Com. wire nails, base per keg	2.95†
Cement c't'd nails, base per keg	2.95†

On plates, shapes, bars, hot-rolled strip and heavy hot-rolled sheets, the base applies on orders of 400 to 9999 lb. All prices are f.o.b. consumers' plants within the Chicago switching district.

*These are quotations delivered to city trade for quantities of 100 lb. or more. For lots of less than 100 lb., the quotation is 65 per cent off. Discounts applying to country trade are 70 per cent off, f.o.b. Chicago, with full or partial freight allowed up to 50c. per 100 lb.

†Prices for city and suburbs only.

NEW YORK

Base per Lb.

Plates, ¼ in. and heavier	3.40c.
Structural shapes	3.37c.
Soft steel bars, rounds	3.31c.
Iron bars	3.26c.
Iron bars, swed. charcoal	6.75c. to 7.00c.
Cold-fin. shafting and screw stock:	
Rounds and hexagons	3.81c.
Flats and squares	3.81c.
Cold-rolled; strip, soft and quarter hard	3.36c.
Hoops	3.56c.
Bands	3.56c.
Hot-rolled sheets (No. 10)	3.31c.
Hot-rolled ann'l'd sheets (No. 24*)	3.89c.
Galvanized sheets (No. 24*)	special
Long terne sheets (No. 24)	5.25c.
Standard tool steel	11.00c.
Wire, black annealed (No. 10)	3.40c.
Wire, galv. (No. 10)	3.75c.
Tire steel, 1 x ½ in. and larger	3.75c.
Open hearth spring steel	4.00c. to 10.00c.
Common wire nails, base, per keg	$3.21

Per Cent Off List

Machine bolts, square head and nut:	
All diameters	70 and 10
Carriage bolts, cut thread:	
All diameters	65 and 10
Boiler tubes:	Per 100 Ft.
Lap welded, 2-in.	$18.95
Seamless welded, 2-in.	19.24
Charcoal iron, 2-in.	24.94
Charcoal iron 4-in.	63.65

*No. 28 and lighter, 36 in. wide, 20c. higher per 100 lb.

ST. LOUIS

Base per Lb.

Plates and struc. shapes	3.45c.
Bars, soft steel (rounds and flats)	3.28c.
Bars, soft †steel (squares, hexagons, ovals, half ovals and half rounds)	3.40c.
Cold-fin. rounds, shafting, screw stocks	3.60c.
Hot-rolled annealed sheets (No. 24)	4.10c.
Galv. sheets (No. 24)	4.65c.
Hot-rolled sheets (No. 10)	3.30c.
Black corrug. sheets (No. 24)	4.10c.
*Galv. corrug. sheets	4.65c.
Structural rivets	4.00c.
Boiler rivets	4.10c.

Per Cent Off List

Tank rivets, 7/16 in. and smaller	55
Machine and carriage bolts, lag screws, fitting up bolts, bolt ends, plow bolts, hot-pressed nuts, square and hexagon, tapped or blank, semi-finished nuts:	
All quantities	70

*No. 26 and lighter take special prices.

PHILADELPHIA

Base per Lb.

*Plates, ¼-in. and heavier	2.98c.
*Structural shapes	2.98c.
*Soft steel bars, small shapes, iron bars (except bands)	2.93c.
‡Reinforc. steel bars, sq. twisted and deformed	2.96c.
Cold-finished steel bars	3.61c.
*Steel hoops	3.43c.
*Steel bands, No. 12 and 3/16 in. incl.	3.18c.
Spring steel	5.00c.
†Hot-rolled aneal. sheets (No. 24)	3.65c.
†Galvanized sheets (No. 24)	4.30c.
*Hot-rolled annealed sheets (No. 10)	3.08c.
Diam. pat. floor plates, ¼ in.	4.95c.
Swedish iron bars	6.25c.

These prices are subject to quantity differentials except on reinforcing and Swedish iron bars.

*Base prices subject to deduction on orders aggregating 4000 lb. or over.

†For 50 bundles or over.

‡For less than 2000 lb.

CLEVELAND

Base per Lb.

Plates and struc. shapes	3.31c.
Soft steel bars	3.00c.
Reinforc. steel bars	2.10c.
Cold-finished steel bars	3.25c.
Flat-rolled steel under ¾ in.	3.36c.
Cold-finished strip	†3.00c.
Hot-rolled anealed sheets (No. 24)	3.96c.
Galvanized sheets (No. 24)	4.61c.
Hot-rolled sheets (No. 10)	3.11c.
Hot-rolled 3/16 in. 24 to 48 in. wide sheets	3.56c.
*Black ann'l'd wire, per 100 lb.	$2.75
*No. 9 galv. wire, per 100 lb.	3.10
*Com. wire nails, base per keg	2.70

†Outside delivery 10c. less

*For 5000 lb. or less

CINCINNATI

Base per Lb.

Plates and struc. shapes	3.42c.
Bars, soft steel or iron	3.17c.
New billet reinforc. bars	3.25c.
Rail steel reinforc. bars	3.25c.
Hoops and bands, 3/16 in. and lighter	3.47c.
Cold-finished bars	3.57c.
Hot-rolled annealed sheets (No. 24)	4.02c.
Galv. sheets (No. 24)	4.72c.
Hot-rolled sheets (No. 10)	3.22c.
Structural rivets	4.35c.
Small rivets	55 per cent off list
No. 9 ann'l'd wire, per 100 lb. (1000 lb. or over)	$2.88
Com. wire nails, base per keg:	
Any quantity less than carload	3.04
Cement c't'd nails, base 100-lb. keg.	3.50
Chain, 1in. per 100 lb.	8.35

Net per 100 Ft.

Seamless steel boiler tubes, 2-in.	$20.37
4-in.	48.14
Lap-welded steel boiler tubes, 2-in.	19.38
4-in.	45.32

BUFFALO

Base per Lb.

Plates	3.38c.
Struc. shapes	3.25c.
Soft steel bars	3.05c.
Reinforcing bars	2.60c.
Cold-fin. flats and sq.	3.40c.
Round and hex.	3.40c.
Cold-rolled strip steel	3.18c.
Hot-rolled annealed sheets (No. 24)	4.06c.
Heavy hot-rolled sheets (3/16 in., 24 to 48 in. wide)	3.63c.
Galv. sheets (No. 24)	4.70c.
Bands	3.43c.
Hoops	3.43c.
Heavy hot-rolled sheets	3.18c.
Com. wire nails, base per keg	$3.35
Black wire, base per 100 lb. (2500-lb. lots or under)	3.55
(Over 2500 lb.)	3.45

BOSTON

Base per Lb.

Beams, channels, angles, tees, zees	3.54c.
H beams and shapes	3.54c.
Plates—Sheered, tank and univ. mill, ¼ in. thick and heavier	3.56c.
Floor plates, diamond pattern	5.36c.
Bar and bar shapes (mild steel)	3.45c.
Bands 3/16 in. thick and No. 12 ga. incl.	3.65c. to 4.65c.
Half rounds, half ovals, ovals and bevels	4.60c.
Tire steel	4.60c.
Cold-rolled strip steel	3.245c.
Cold-finished rounds, squares and hexagons	3.90c.
Cold-finished flats	3.75c.
Blue annealed sheets, No. 10 ga.	3.65c.
One pass cold-rolled sheets No. 24 ga.	4.20c.
Galvanized steel sheets, No. 24 ga.	4.90c.
Lead coated sheets, No. 24 ga.	5.85c.

Prices delivered by truck in metropolitan Boston, subject to quantity differentials.

DETROIT

Base per Lb.

Soft steel bars	3.09c.
Structural shapes	3.42c.
Plates	3.42c.
Floor plates	5.17c.
Hot-rolled annealed sheets (No. 24)	3.94c.
Hot-rolled sheets (No. 10)	3.14c.
Galvanized sheets (No. 24)	4.72c.
Bands	3.39c.
Hoops	3.39c.
Cold-finished bars	3.49c.
Cold-rolled strip	3.18c.
Hot-rolled alloy steel (S.A.E. 3100 Series)	5.29c.*
Bolts and nuts	70 and 5 per cent off list

Prices delivered by truck in metropolitan Detroit, subject to quantity differentials.

*Price applies to 1,000 lb. and over.

MILWAUKEE

Base per Lb.

Plates and structural shapes	3.31c.
Soft steel bars	3.06c.
Hot-rolled strip	3.41c.
Hot-rolled sheets (No. 10)	3.16c.
Hot-rolled annealed sheets (No. 24)	3.96c.
Galvanized sheets (No. 20)	4.66c.
Cold-finished steel bars	3.46c.
Cold-rolled strip	3.33c.
Structural rivets (keg lots)	3.86c.
Boiler rivets, cone head (keg lots)	3.96c.
Boiler rivets, rd. head (keg lots)	3.86c.
Track spikes (keg lots)	3.71c.
Track bolts (keg lots)	4.86c.
*Black annealed wire	3.25c.
†Com. wire nails	2.95c.
Cement coated nails	2.90c.

Per Cent Off List

Machine bolts	70 and 10
Carriage bolts	70 and 10
Hot-pressed nuts, sq. and hex. tapped or blank (keg lots)	70 and 10

Prices given above are delivered Milwaukee.

On plates, shapes, bars, hot-rolled strip and heavy hot-rolled sheets, the base applies on orders of 400 to 9999 lb. On galvanized and No. 24 hot-rolled annealed sheets the prices given apply on orders of 400 to 1500 lb. On cold-finished bars the prices are for orders of 1000 lb. or more of a size.

*For quantities of 500 to 2500 lb. assorted black annealed and galvanized wire.

†For orders of 50 kegs or less.

ST. PAUL

Base per Lb.

Mild steel bars	3.20c.
Structural shapes	3.45c.
Plates	3.45c.
Cold-finished bars	3.87c.
Bands and hoops	3.55c.
Hot-rolled annealed sheets, No. 24	3.90c.
Galvanized sheets, No. 24	4.50c.
Cold-rolled sheets, No. 20	4.95c.

On mild steel bars, shapes, plates and hoops and bands the base applies on 400 to 14,999 lb. On cold-finished bars, hot-rolled sheets, galvanized sheets and cold-rolled sheets base applies on 15,000 lb. and over.

BALTIMORE

Base per Lb.

*Mild steel bars	2.95c.
*Iron bars	2.95c.
*Reinforcing bars	2.95c.
*Structural shapes	3.00c.
†Plates	3.00c.
†Hot-rolled sheets, No. 10	3.10c.
‡Hot-rolled annealed sheets, No. 24	3.60c.
‡Galvanized sheets, No. 24	4.30c.
*Bands	3.20c.
*Hoops	3.45c.
§Cold-rolled rounds	3.85c.
§Cold-rolled squares, hex. and flats	3.55c.
Rivets	4.40c.
Bolts and nuts, per cent off list	60 and 10

*Quantity extras per size apply. †Quantity extras per thickness apply. Hot-rolled quantity extras are: 2000 lb. and over, base; 1500 lb. to 1999 lb. add 15c. per 100 lb.; 1000 lb. to 1499 lb., add 30c.; 0 to 999 lb., add 50c.

250 bundles and over, base. For 1 to 9 bundles add 50c. per 100 lb.; for 10 to 49 bundles add 25c.

‡Base for 1000 lb. and over. For 500 to 999 lb. add 25c. per 100 lb.; for 300 to 499 lb. add 75c.; for 0 to 299 lb. add $1.25.

CHATTANOOGA

Base per Lb.

Mild steel bars	3.31c.
Iron bars	3.31c.
Reinforcing bars	3.31c.
Structural shapes	3.56c.
Plates	3.56c.
Hot-rolled sheets, No. 10	3.36c.
Hot-rolled annealed sheets, No. 24	4.31c.
Galvanized sheets, No. 24	4.36c.
Steel bands	3.61c.
Cold-finished bars	3.98c.

MEMPHIS

Base per Lb.

Mild steel bars	3.42c.
Shapes, bar size	3.42c.
Iron bars	3.42c.
Structural shapes	3.67c.
Plates	3.67c.
Hot-rolled sheets, No. 10	3.47c.
Hot-rolled annealed sheets, No. 24	4.27c.
Galvanized sheets, No. 24	4.97c.
Steel bands	3.72c.
Cold-drawn rounds	3.89c.
Cold-drawn flats, squares, hexagons	5.89c.
Structural rivets	4.25c.
Bolts and nuts, per cent off list	65
Small rivets, per cent off list	50

NEW ORLEANS

Base per Lb.

Mild steel bars	3.30c.
Reinforcing bars	3.50c.
Structural shapes	3.55c.
Plates	3.55c.
Hot-rolled sheets, No. 10	3.55c.
Hot-rolled annealed sheets, No. 24	4.50c.
Galvanized sheets, No. 24	4.95c.
Steel bands	3.95c.
Cold-finished steel bars	4.15c.
Structural rivets	4.25c.
Boiler rivets	4.25c.
Common wire nails, base per keg	$3.10
Bolts and nuts, per cent off list	70

PACIFIC COAST

Base per Lb.

	San Francisco	Los Angeles	Seattle
Plates, tank and U. M.	3.50c.	3.60c.	3.55c.
Shapes, standard	3.50c.	3.60c.	3.55c.
Soft steel bars	3.50c.	3.60c.	3.70c.
Reinforcing bars, f.o.b. cars dock Pacific ports	2.45c.	2.45c.	2.45c.
Hot-rolled annealed sheets (No. 24)	4.25c.	4.35c.	4.40c.
Hot-rolled sheets (No. 10)	3.60c.	3.70c.	3.75c.
Galv. sheets (No. 24)	5.00c.	4.95c.	5.00c.
Cold finished steel Rounds	5.80c.	5.85c.	6.00c.
Squares and hexagons	7.05c.	7.10c.	7.25c.
Flats	7.55c.	7.60c.	8.25c.
Common wire nails —base per keg less carload	$3.20	$3.20	$3.20

All items subject to differentials for quantity.

TOOL STEEL

Prices are same for warehouse distribution at all points on or East of Mississippi River. West of Mississippi quotations are 1c. a lb. higher.

Base per Lb.

High speed	57c.
High carbon chrome	37c.
Oil hardening	22c.
Extra	17c.
Regular	14c.

Steel Demand Less Active In Philadelphia District

Ingot Production Is Maintained Despite Decline in Orders — Heavy Melting Steel Price Is Lower

PHILADELPHIA, Oct. 8.—The buoyancy which characterized this market at the beginning of the month has given way to a feeling of hesitancy. Demand for finished steel products had increased steadily during September, and the current check is rather hard to explain. On bars, galvanized sheets and billets, price increases drove in some additional tonnage last month, and these products are now especially quiet; but this does not explain lessened demand for other lines.

The outbreak of hostilities in Africa seems to have had no appreciable effect on the steel market here. Munitions makers have been enjoying no business from the combatants and would have little chance of getting any even if there were no embargo. However, the entire situation has provoked a feeling of uncertainty which may be partially responsible for lighter steel buying.

Steel ingot production in the Philadelphia territory is unchanged at 40 per cent of capacity. Two independent companies had plans for placing additional open-hearth furnaces in operation this week, but they may not now be required. Finishing mill schedules are slightly lower in some instances.

Prospective construction work is the brightest feature of the market. Philadelphia is undertaking a school-building program which will call for expenditures of $8,000,000. The proposed tunnel under the Delaware River here will be of reinforced concrete construction, if it is built, and a large tonnage of bars will be required. Highway and grade elimination work is reaching the engineering stage in Pennsylvania and more than 100 projects are now being figured at Harrisburg.

No. 1 heavy melting steel scrap has declined 50c. to $12 a ton.

Pig Iron

Furnace representatives in this territory have been able to accumulate order books for the first time in more than a year. Heretofore, iron had been ordered and shipped almost simultaneously. Most of the increase in business in recent weeks has come from small consumers, as the larger buyers are conspicuously out of the market. Cast iron pipe foundries are operating at only about 25 per cent and have more than enough iron to last them for the remainder of the year. Foreign iron is also moving to these consumers, as 7200 tons was unloaded at Philadelphia last month. The Netherlands and India were the principal sources, although a small tonnage came from Sweden. Stove foundries are more active pig iron buyers, but steel foundries catering to the railroads are practically out of the market.

Bars, Plates and Shapes

The Philadelphia Board of Education has been promised PWA

funds to cover part of an $8,000,000 school-building program. From 12 to 14 buildings are involved, to be used for elementary, junior high and senior high school purposes, and as much as 5000 tons of shapes and reinforcing bars may be required. The State Highway Department at Harrisburg is also preparing plans for more than 100 highway and grade separation projects which will be let during the winter for early spring construction. Shipyards are still busy, and repairs to two recently damaged ocean liners will be made in this district. The light cruiser on which the Navy Department took new bids last week was awarded to the Newport News Shipbuilding & Drydock Co. Tank fabricators are fairly busy, with some of them able to operate five days a week on a single-turn basis. Decision has been reached to build the proposed Philadelphia-Camden tunnel of reinforced concrete if the necessary funds can be obtained, and a huge tonnage of bars would be required. Bids will be taken Oct. 16 on a reservoir at Reading, Pa., which will take 1150 tons of bars.

Sheets and Strip

Although the principal consumers of flat-rolled steel in this district are maintaining recent schedules, demand for sheets and strip steel is somewhat lighter. Galvanized material is naturally dull because jobbers stocked up rather heavily last month while their $2 differential was still in force. Automobile body builders are producing principally for dealer stocks and are not expected to become especially active until after the show early in November. Stovemakers are in their busy season and are taking enameling stock in sizable quantities. The radio business is spotty, with some makers quite busy while others are almost out of production. Sheet prices are being well maintained.

Warehouse Business

While September sales of steel products out of warehouse were in the best volume in several months, the new month has started off rather inauspiciously. However, demand is well diversified and represents minor building requirements in many instances.

Imports

The following iron and steel imports were received here last week: 550 tons of chrome ore and 98 tons of pig iron from British India; 494 tons of steel sheets, 16 tons of steel bars and five tons of structural shapes from Germany; 72 tons of structural shapes, 12 tons of steel bars and five tons of steel bands from Belgium, and 55 tons of steel wire, 38 tons of steel bands, 36 tons of steel tubes and seven tons of steel forgings from Sweden.

Scrap

No. 1 heavy melting steel has been purchased by two consumers during the last week at $12 and the market is off 50c. a ton. The No. 2 grade is still relatively strong because of the large number of current users and dealers who are paying $11 freely to cover old orders. Carwheels are stronger at $12.50 to $13 and shafting and steel axles are up 50c. a ton. Export buying is somewhat limited, as dealers are entering on no new contracts until shipping restrictions are fully understood.

Large Awards On Coast

SAN FRANCISCO, Oct. 7.—Pacific Coast Steel Corpn. was the successful bidder on two contracts involving major tonnages. One was 5500 tons of structural steel for transmission towers for the Metropolitan Water District and the other was 3300 tons of steel sheet piling for the United States Coast Guard bulkhead, to be constructed at Government Island, Cal. The reappearance of the Colorado Fuel & Iron Co. in the Pacific Coast territory is seen in the award to it of 1054 tons of billet steel for the mint at San Francisco. The 3419 tons of bars, placed by the United States Engineers at Los Angeles with California Hardware Co., is reported to have been sublet to Colorado Fuel & Iron Co. Other lettings were limited to minor tonnages.

Added to the pending list during the past week were pipe lines at Everett and Tacoma, Wash. Approximately 1000 tons of plates will be required on the former, while 1400 or 2100 tons, depending on the acceptance of steel or concrete alternates, will be placed for the Green River pipe line at Tacoma. Barracks and other buildings, to be constructed at Pearl Harbor, T. H., will require a maximum of 1050 tons of reinforcing bars.

With $20,000,000 alloted by the Federal Government, renewed interest is being given the Central Valley project to be undertaken in California. Steel tonnage estimates made some time ago show that approximately 5348 tons of structural steel, 5995 tons of reinforcing bars and 14,991 tons of plates will be used on the project. Which unit of the project is to be undertaken first has not yet been determined and it is generally believed that it will be many months before contracts involving steel will be up for bids.

Although activity in central California has been limited, the PWA projects listed in this territory may be stimulating. It is reported that there is work contemplated, calling for an expenditure of $16,000,000, which must be started before the end of the quarter to fulfill conditions of the allotments. Steel business in southern California and in the Northwest continues active.

Cleveland Benefits from Increased Automotive Buying

Open-Hearth Output Is Unchanged But a Bessemer Converter Has Been Added—C. & O. Buys 21,842 Tons of Rails

CLEVELAND, Oct. 8.—An increase in orders from the motor car industry is the feature of the market, and this is reflected in the putting on of two open-hearth furnaces by a Cleveland producer of sheet and strip steel. Two open-hearths were taken off in Lorain and in their place a Bessemer converter was started up. These changes leave the open-hearth ingot output in the Cleveland-Lorain territory at 59 per cent of capacity, the same as last week.

Improved demand from the automotive industry has stimulated sheet business in particular. While there was no spectacular buying of large tonnages, most of the leading consumers in the automotive field during the week placed new orders and for larger lots of steel than they have been buying recently. This new buying indicates that the motor car manufacturers are about ready to get under production on new models.

Miscellaneous demand for finished steel is well maintained. Refrigerator manufacturers have placed new orders for sheets and are expected to get under production shortly on new models. Sheets are moving in good volume to makers of stoves, washing machine tubs and other household equipment. Rail purchases were completed for the year by roads centering here, with the placing by the Chesapeake & Ohio of 21,842 tons with four mills. This road also distributed 1000 tons of track fastenings.

Pig iron continues active in sales, and shipments are gaining. If producers carry out their announced intention of advancing prices, the new prices will not become generally effective until the first quarter because so many consumers are now under contract.

Steel prices are steady. Objection of drop forgers to the sharp advance on 4 by 4-in. forging billets resulting from putting them on a bar base has led to talk of a price revision for the first quarter.

Pig Iron

Considerable business is still coming out in fourth quarter contracts, although the volume is not so heavy as in September. Orders placed during the week were for lots up to 1000 tons. It is estimated that fully 80 per cent of consumers have purchased iron for the quarter. Supplemental purchases have been made by some foundries that bought iron last month. Shipments continue to gain. Sellers declare that a price advance is inevitable before the end of the quarter, and some are talking of an advance of as much as $1 a ton.

Iron Ore

Shipments are beginning to fall off and the October movement will

be considerably less than in September, when water shipments of 4,817,614 tons established a record for the season. Present estimates are that water shipments for the season will not exceed 28,000,000 tons and may not be much over 26,000,000 tons.

Sheets

New business from the motor car industry took an upward spurt the past week, reflecting the stepping up in production on new models. Instead of buying large tonnages automobile manufacturers are placing orders only for their rather early needs. Some business was placed by the local Fisher Body plant. Refrigerator manufacturers, who placed small orders a few weeks ago, are now getting under production on new models and made some additional purchases during the week. Barrel manufacturers have become fairly busy, largely on alcohol containers, and new business continues to come from that source. As some of the mills allowed jobbers a $2 a ton differential on galvanized sheets on orders placed up to Sept. 30, a test of the price advance to jobbers has not yet been made. The local sheet mills are operating at close to capacity this week, and the Monroe, Mich., plant is again in operation.

Bars, Plates and Shapes

Demand for hot-rolled bars, particularly from forge shops, shows quite a gain. While this is largely due to new releases for automobile forgings, the new quantity differential price set-up is evidently a factor in increasing sales and also increasing the quantities ordered. In the construction field, plans will be out shortly for three grade crossing elimination projects in the Cleveland area, for which PWA funds have been provided. These are expected to take 2000 tons of structural shapes and a considerable quantity of reinforcing bars. Mills are exerting pressure against distributers who shade regular prices for reinforcing bars, and, as an evident result of this, slight price concessions made recently on 150 tons for public work here have been withdrawn and it is understood that the steel will go to a Cleveland distributer who adhered to the regular price. Plates show an improvement in small-lot orders.

Strip Steel

While orders are better, demand from the automotive industry has not improved to the same extent as for sheets. General Motors parts plants are taking good shipments against old orders and are expected to come in the market again around the middle of the month.

Rails

Chesapeake & Ohio Railroad has placed 21,842 tons of rails, allocating the tonnage as follows: Inland Steel Co., 7426 tons; Illinois Steel Co., 9414 tons; Carnegie Steel Co., 2818 tons, and Bethlehem Steel Co., 2184 tons. The Chesapeake & Ohio has also placed approximately 1000 tons of tie plates, splice bars and spikes, dividing the business between quite a number of makers.

Scrap

The market is almost lifeless but firm at recent levels. Shipments to the Youngstown district have been slowed down by suspension by one consumer and the placing of restrictions by another. As a result, purchases by dealers to cover against outstanding orders have declined. Local mills continue to take heavy melting steel and blast furnace scrap, but do not have much scrap due on contracts.

United Gets Armco Hot Mill Order

THE United Engineering & Foundry Co., Pittsburgh, has received contract from the American Rolling Mill Co., Middletown, Ohio, for an 80-in. hot mill stand to supplement American Rolling Mill's existing stands of continuous hot-mill train at Middletown, which are being widened to 80 in. This contract is in addition to the orders placed with United previously for three stands of an 80-in. four-high cold strip continuous mill. The newest mill on order will roll hot coils for subsequent rolling on the three stands of cold mill. In addition, United Engineering has received an order for accessory equipment to widen the hot mills.

For use with the various strip mills now on order, United Engineering has developed finishing equipment which is claimed to cut down handling costs and improve the quality of steel rolled. Part of this equipment consists of an automatic coil welding unit for preparation of largest coils for cold strip rolling and flying shears of the precision type, a large number of which have been ordered for finishing departments by steel companies.

THE dining car of the Abraham Lincoln, new light-weight Baltimore & Ohio passenger train (THE IRON AGE, page 48, May 9), has been made entirely of metal.

The structural members and exterior covering of the car are of high-tensile steel. The interior wall covering is aluminum-face plymetal.

The dining compartment is connected by kitchen with a lunch room. Monel metal is used for the kitchen appointments.

The Abraham Lincoln was built by the American Car & Foundry Co.

Output Higher At Buffalo

BUFFALO, Oct. 8.—The augmented operation at Lackawanna plant of the Bethlehem Steel Co. predicted last week has become a fact and the plant is continuing on 14-furnace operation. Republic Steel Corpn. and Wickwire Spencer Steel Co. continue to operate respectively four and two furnaces. The Seneca sheet division of Bethlehem is operating at 80 per cent of capacity.

Steel fabricators are keeping busy on a volume of small jobs now being placed. A State bridge at Canisteo, N. Y., will require 300 tons of structural steel and a standpipe at Dunkirk, N. Y., will take 300 tons of plates. Two State bridges in Jefferson County will require 125 tons apiece. On the recent sizable PWA allotment for projects in New York State, it is understood that steel bidding may be somewhat delayed. The construction of these projects must be started by Dec. 15, but in many cases to comply with the law concrete will be poured, and the steel contracts left until later.

It is understood that a few cars of No. 1 heavy melting steel were sold to a local mill at $13, but no sizable tonnage transactions are reported. It is reported that one large mill here is paying $12, dock, for No. 1 steel, paying the transportation charge of 75c. per ton; so far the equivalent has not been offered dealers here.

Pig iron business continues in fair volume. Bethlehem's Lackawanna plant continues to operate three blast furnaces for the time being, though this is said to be a change-over schedule.

Canadian Trade Improves

TORONTO, Ont., Oct. 8.—New business in the Canadian iron and steel markets continues to show favorable expansion and is resulting in increased activities for the various branches of the steel industry. Both mills and foundries are operating on higher schedules than at any previous time since 1930 and the former are carrying substantial backlogs. The Steel Co. of Canada, Ltd., Hamilton, is maintaining full time operation at its sheet mill and still is said to be about a month behind with deliveries. Algoma Steel Corpn., Sault Ste. Marie, Ont., and Dominion Steel & Coal Corpn., Sydney, N. S., have large orders on hand for steel rails and also report increased volume of smaller business. Car and locomotive works are preparing to step up operations as a result of the orders received from the Canadian National and Canadian Pacific railways. The automotive industry is entering the market for supplies in connection with the 1936 car program and there is a steady demand for steel and equipment from the mining industry. The agricultural implement industry reports good demand for implements for domestic use as well as export.

Demand for scrap has improved. Shipments of heavy melting steel and other steel grades to the mills in the Hamilton district have advanced sharply. Montreal dealers also report better domestic demand for steel scrap, but state that shipments to Britain have dried up for the season. Dealers both in Toronto and Montreal have advanced price lists 50c. to $1 a ton.

Heavy Rolled Products More Active at New York

Construction Projects Call for Substantial Tonnages—Cruiser Will Require 6000 Tons—War Demand for Tin Plate Appears

NEW YORK, Oct. 8.—Demand for heavy rolled products is looming larger in this market. The Navy Department has awarded a 10,000-ton cruiser to the Newport News Shipbuilding & Dry Dock Co., and 1600 tons of special treatment steel and 4500 tons of carbon steel will be required. A number of large structural steel and reinforcing projects are pending or will soon come up for figures.

Bids will be taken Oct. 17 on the Manhattan approach to the Triborough bridge, New York, contract 48, requiring 5400 tons of structural steel and 1500 tons of reinforcing bars. Tenders will be received Oct. 10 on 1000 tons of structural steel, including 750 tons of carbon and 250 tons of silicon steel for Randall's Island junction, contract 47, Tri-borough bridge. On the same date figures will be taken on 5750 tons of reinforcing steel for contract 47, as noted a week ago. On Oct. 15 bids will be taken on four public schools in New York, requiring 7500 tons of structural steel. Among prospective projects are a section of the West Side elevated highway between Forty-ninth and Fifty-seventh Streets, requiring 12,000 tons, and a section between Seventy-sixth and Seventy-ninth Streets, calling for 2700 tons. An addition to the Bellevue Hospital, New York, involves 3500 tons.

The New York Central has not yet awarded contracts for its fourth quarter steel on which it took bids Sept. 26, except for rolled steel wheels.

Total bookings in finished steel are holding up fairly well despite a falling off in bars and galvanized sheets following the anticipatory buying of last month. Sheet and strip tonnage continues in good volume and tin plate business is satisfactory considering the season.

Local exporters have received inquiries for tin plate in oil can sizes from Alexandria and Port Said, Egypt. Presumably the cans will be used to ship oil to Ethiopia.

Pipe-producing nations of the world will be represented at a meeting to be held in Europe this week. It is hoped that the quota differences between France and Germany can be patched up and the International Pipe Cartel reestablished.

Pig Iron

Consumers continue to enter the market for fair-sized tonnages, and the situation is about the same as when last reported. Bookings last week came to about 5400 tons as against 5800 tons sold in the prior period. Sentiment over prices appears to be divided. Some producers contend that an increase would impair sales because foundries definitely would not be able to secure correspondingly higher prices for castings. Nevertheless, the probability remains, and buyers have been covering future positions with this in mind. Current shipments are not on a parity with orders, although some spot business continues to be done. Dutch iron to the extent of 5000 tons was unloaded at Boston last week.

Reinforcing Steel

Increasing demand in this area has considerably enlivened the market, although price shading continues. As previously reported, the 5750 tons needed for the Randall's Island junction of the Tri-borough bridge will be closed to bidders Oct. 10. The Bridge Authority specifies Oct. 17 as the deadline for tenders on 1500 tons of bars for the Manhattan approach to the bridge. About 1900 tons for highway purposes is active through combined State and Federal agencies.

Scrap

The actual outbreak of hostilities in Africa has had little or no effect on the local scrap market. Scrap is not expected to be placed on the list of war materials on which the President placed an embargo last week, but no new Italian commitments are being made at present. Japan looms as a probable buyer again, but current purchases for export are light. The domestic market is also quiet. Eastern Pennsylvania consumers are showing no disposition to enter the market and old orders in that territory are being cleaned up. Foundries in the metropolitan district are more active and purchases of the cast grades are somewhat more numerous. Prices on all grades are unchanged.

Ensley Rail Mill to Resume

BIRMINGHAM, Oct. 8. — For a part of last week steel production was the highest in 15 months. During the first half of the week 14 open-hearths were in production, a rate of 58.3 per cent. Since Thursday there have been 13 active. This schedule will likely be followed during the current week. For a few days the Tennessee Coal, Iron & Railroad Co. operated all nine of its Fairfield open-hearths, the first time in years that such has been the case. One was taken off last Thursday, leaving eight in production. Gulf States Steel Co. continues to work five out of six at Alabama City.

The Ensley rail mill will reopen on Oct. 14 for a short run. Announcement was made last week that Mobile & Ohio railroad had purchased 2000 tons of rail. The Tennessee company also has an order of 6000 tons from the Seaboard Air Line railway, placed in August, and it is stated that some other tonnage has been booked.

Steel buying has been unusually active. September was the best month of the year, and the momentum has continued into October. While the new price basis brought in a large amount of new business, consumer demand has also contributed substantially to the upturn.

Woodward Iron Co. blew in a second stack No. 3 last week and the active total for the district is now seven. Pig iron demand is mostly on a spot, small-lot basis, but there has been a fair amount of contract buying. Local furnaces started the fourth quarter with more forward business than at the start of any previous quarter this year.

Cast iron pipe business has been sluggish, owing to the slowing down of PWA projects. September bookings and shipments were considerably below those of the previous three months.

Scrap Advances At St. Louis

ST. LOUIS, Oct. 8.—Shipments of pig iron during September were estimated to be four times as great as in September last year, and requests for shipments against fourth-quarter contracts would indicate that the movement this month will be still larger. Bookings for fourth quarter are said to be three times as heavy as in the same quarter a year ago. Because of anticipatory covering by melters, sales at present are light. The melt in the St. Louis territory is holding up well. The implement industry in the Tri-cities continues at top rate of production, rivaling 1928, if not exceeding that peak year. The stove industry has taken another spurt as a result of the beginning of cold weather.

Warehouse business in St. Louis for September is estimated to have been about 35 per cent ahead of last September and about 10 per cent ahead of August this year, the demand for boiler tubes being outstanding. Mills report a freer movement of sheets, principally from the stove manufacturers, and bale ties. While the movement of wire products has slackened, it still is in fair volume. All of the steel fabricating plants in the St. Louis industrial district are operating, the average having been stepped up to 40 per cent of capacity. The State of Missouri will open bids on Oct. 11 for highway bridges requiring 840 tons of structural steel. Steirs Brothers Construction Co. is general contractor for the Watson Road bridge, St. Louis, requiring 100 tons of reinforcing bars.

Selected heavy steel scrap advanced 75c. a ton and No. 1 heavy melting steel was up 50c. a ton following the purchase of several thousand tons of these items by an East Side melter. Bundled sheets rose 50c. a ton and No. 2 railroad wrought 75c. a ton in sympathy with markets east of here. A list of 1500 tons of the St. Louis-San Francisco Railway closed today.

Cast Iron Pipe

New York closed bids Oct. 4 on 1500 tons of 6 to 20-in. for its waterworks department.

Milwaukee will take bids Oct. 10 on 500 tons of 12-in.

Kaukauna, Wis., has placed 5000 ft. of water pipe with James B. Clow & Sons.

Board of Public Service, City Hall, St. Louis, asks bids until Oct. 22 for 10-in. for new trunk water main from Halls Ferry Circle to point near St. Louis Training School, St. Louis County. Cost about $22,000.

Seville, Ohio, plans pipe lines for water supply. Fund of $100,000 is being arranged through Federal aid for this and other waterworks installations. P. W. Elwell, Euclid Avenue, Cleveland, is consulting engineer.

Ishpeming, Mich., plans pipe lines for water system. Fund of $169,000 has been secured through Federal aid for this and other waterworks construction. Gunnard Anderson is city engineer in charge.

Jackson County Water Supply District, care of C. A. Haskins, Finance Building, Kansas City, Mo., consulting engineer, plans pipe lines for water supply in part of suburban area in Jackson County, including trunk mains and distributing lines. Cost about $325,000. Financing is being arranged through Federal aid.

Cayce, S. C., plans pipe lines for water system, including trunk line across Congaree River to Columbia, S. C., where supply will be secured; installation will include elevated steel tank and other equipment. Appropriation of $46,365 has been secured through Federal aid. Ryan Engineering Co., Columbia, is consulting engineer.

Clay Center, Kan., plans pipe lines for water supply; also 500,000-gal. elevated steel tank and tower. Fund of $30,000 has been secured through Federal aid. Charles A. Haskins & Co., Finance Building, Kansas City, Mo., are consulting engineers.

Duquoin, Ill., asks bids until Oct. 17 for pipe for water system; also for elevated steel tank and tower, filtration plant and other waterworks equipment. Cost about $265,000. Financing has been completed through Federal aid. Russell & Axon, 4903 Delmar Boulevard, St. Louis, are consulting engineers.

Sandoval, Ill., closes bids Oct. 18 for 2, 4 and 6-in. for water system; also for 60,000-gal. elevated steel tank and tower. Cost about $69,000. Kinsey Engineering Co., 20 South Central Avenue, St. Louis, is consulting engineer.

Palisade, Colo., plans 4, 6 and 8-in. for water supply; also new concrete reservoir and other waterworks installation. Fund of $105,000 is being arranged through Federal aid. Jay W. McCullough, Majestic Building, Denver, Colo., is consulting engineer.

Clay, W. Va., closes bids Oct. 15 for pipe for water system and other waterworks installation. J. E. Settle, Security Bank & Trust Building, Charleston, W. Va., is consulting engineer.

International Falls, Minn., plans pipe lines for water supply. Fund of $175,000 is being arranged through Federal aid for this and other waterworks construction. P. C. Warner is city engineer. Toltz, King & Day, Inc., Pioneer Building, St. Paul, Minn., is consulting engineer.

Sparland, Ill., closes bids Oct. 17 for pipe for water system and other waterworks installation. Fund of $31,000 has been arranged. L. B. Kinsey, Pekin, Ill., is consulting engineer.

Portland, Ore., will take bids Oct. 17 on 836 tons of 3 to 8-in. with alternates on steel pipe.

The Division of Simplified Practice of the Bureau of Standards has announced that simplified practice recommendation R58-28, classification of iron and steel scrap, has been reaffirmed without change by the standing committee of the industry. This recommendation was first approved at a general conference of the industry held in 1926. The first revision which became effective on Jan. 1, 1928, has since been in effect. The recommendation specifies classes of scrap for blast, basic open-hearth, acid open-hearth and electric furnaces, for gray iron foundry practice, Bessemer converters, and for miscellaneous scrap. A contract form for purchase of scrap is also included. Copies of the recommendation in mimeographed form may be obtained from the bureau.

Valley Mills Still Lack Support of Expected Automotive Buying

YOUNGSTOWN, Oct. 7.—Finished steel demand in the Valleys is holding the pace set in September, but expected expansion in buying of automobile steel has not materialized. Consequently, minor fluctuations in general finished steel orders continue to be reflected in open-hearth and Bessemer schedules. The net change in the current period probably will be slightly downward. Production at the outset of the week at Youngstown, Canton, Massillon and Warren is scheduled at around 53 per cent of capacity, a drop of two points from last week's rate. Stocks of ingots and semi-finished steel are not long, however, and it is believed here that raw steel production will climb almost simultaneously with the long-awaited heavy buying of automotive steel.

There is little, if any, relative change in individual production schedules. The Republic Steel Corpn. is running almost at capacity at Warren, reflecting the preponderance of orders for flat-rolled products. The Youngstown Sheet & Tube Co. is operating 11 out of 12 open-hearths at the Campbell works, but is keeping the Brier Hill plant idle. The Carnegie Steel Co. is operating 12 out of 15 open-hearths at its Ohio works. Bessemer capacity at all plants is engaged intermittently, with the average running about 40 per cent.

Finishing mill schedules are holding. Practically capacity operations are reported at the Youngstown Sheet & Tube Co.'s cold strip mill, with the hot-strip mill on a five-day week. Seamless pipe production is running better than 50 per cent in one instance, but lagging output of lap-weld and butt-weld is dragging down the general average. Absence of line pipe tonnage also is a deterring influence. Wire mills are maintaining fairly high production, largely on demand for manufacturers' wire.

Pig iron demand has improved materially during the past fortnight, perhaps chiefly in view of the higher prices for fuel resulting from the new bituminous mine wage agreements signed by independent operators and "captive" mine owners alike. Regardless of the general belief that pig iron prices will not soon reflect the higher fuel costs, consumers are covering more liberally and for extended delivery, quarterly contracts now being closed more frequently.

The Valley scrap market has assumed a slightly easier tone. Mills evidently are waiting out dealers, and offers to sell No. 1 heavy melting steel are becoming more pressing. No major sale of that grade has been reported since mid-September, and the market remains nominally quotable at $14, delivered. One offer to sell at $13.75, delivered, foreshadows a slightly lower market, provided that quotation remains in force on a sizable purchase. Of considerable interest is the report that the New York Central failed to receive any bids for the No. 1 heavy melting steel on its recent scrap list. Likewise, the Erie Railroad failed to dispose of the heavy melting steel on its last list.

The prospective removal of the Republic Steel Corpn.'s offices to Cleveland on Jan. 1, while dealing a blow to Youngstown retail business, does not imply any lessening in importance of the Valleys as a steel-producing district. Although most of the Republic administrative forces will be lodged at Cleveland, a district sales and operating staff will be retained at Youngstown. It is unlikely that mill staffs or payrolls will be noticeably affected by the move.

Cincinnati District Is More Active

CINCINNATI, Oct. 8.—Increases in coke prices and indications of higher costs of other furnace materials have prompted smaller pig iron buyers to place covering orders. Other users, however, are relying on the furnace custom of allowing time to cover before the effective dates of new schedules. Total purchases of the week approached 2000 tons, of which about 1000 was Southern iron. Except for 200 tons of Southern sold to an Indiana melter, new business was in 100-ton lots and less. Foundry operations continue to move upward at a conservative pace, current levels being slightly above 50 per cent.

Movement of foundry coke is better despite price advances Oct. 1. By-product foundry coke from Northern sources is quotable at $9.50, delivered in Cincinnati, with Birmingham maintaining a 25c. differential.

Sheet steel demand, the past week, was increased under the stimulus of expanding automotive specifications. Some producers report a decline in miscellaneous demand, but the leading interest indicates bookings in excess of 100 per cent, which tended to offset the slight recession in other quarters.

Steel ingot production moved upward a few points to 84 per cent as producers sought to accommodate demands. In fact, two units, in this area, report all open-hearths in operation while others are above 50 per cent.

Foundry grades of scrap are more active, with dealers making several moderate sales at increased prices. Mill pressure on quotations, however, is retarding activity in steel grades. Dealers, having placed themselves long in anticipation of heavy buying this quarter, refuse mill overtures and insist on prices commensurate with bid schedules.

Boston Jobbers Advance Bars

BOSTON, Oct. 8.—Warehouses have advanced prices on hot-rolled bars 10c. per 100 lb. and have established new extras and quantity differentials on cold-finished bars, which represent a substantial advance although the base price remains unchanged. Otherwise warehouse lists have not been changed.

Some furnace representatives booked considerable fourth quarter business in pig iron in the past week, while others did virtually nothing. In the aggregate, bookings were somewhat less than for the preceding week. There are no open inquiries in the market, but numerous foundries are privately negotiating with furnaces for small to medium-sized tonnages, with indications of business being fairly well spread out throughout October. Because of increased cost of fuel an advance in pig iron within the near future is regarded as a possibility.

Business in scrap has dropped to very small proportions because of lack of vessel space, high insurance rates and other uncertainties in the export situation, as well as because of the Jewish holidays and lack of consumer interest in the domestic market. Although there is a firmer feeling in Pennsylvania No. 1 heavy melting steel prices, it has not been reflected here, quotations all through the list being unchanged and nominal.

Local and other New England prices on foundry coke have not been changed, but those on some grades of Pennsylvania coke have been raised 35c. a ton.

Copper Advanced to 9.25c. a Lb. In Sympathy With High Continental Price

Lead and Zinc Prices Increased Ten Points While Tin Strengthens Despite Raising of Production Quota

NEW YORK, Oct. 8.—Unusual activity abroad has induced domestic sellers to mark up the price. Late yesterday a few transactions took place at 9.25c. a lb., and this morning found the new position officially established. With the foreign market serving as a barometer, home interests watched English prices on electrolytic mount steadily until sales at 9.05c. a lb. were recorded Oct. 5 and at 9.10c. a lb. yesterday. Precautionary buying throughout the week reached heavy proportions, but this morning, following the $5 a ton price increase, a slight reaction set in. Sales last week totaled 17,474 tons, and it is thought that yesterday's turnover was greatly in excess of any other day during the week.

Lead

Renewal of heavy demand pushed prices $2 a ton higher yesterday. As in the case of copper, an active foreign condition must be held partly accountable. However, domestic consumption fully justifies the movement as indicated by the volume of new business being entered on producers' books. Sales last week by one leading seller totaled 19,000 tons, a higher figure than for any similar period since 1930. Furthermore, little or no let-up occurred as a result of higher prices, and producer daily allotments continue to be absorbed before all inquiries are satisfied. Quite substantial waiting lists are being built up as a result. The new price levels of 4.60c. a lb., New York, and 4.45c. a lb., St. Louis, appear well established.

Tin

Brisk buying for nearby positions last week left no spot Straits metal available here today. Prices consequently moved up although today's figure of 51c. a lb., New York, for spot Straits is purely nominal. Official stocks in domestic warehouses now amount to only 250 tons, all of which is held under contract through prior commitment. Likewise, pending arrivals have practically been sold out in advance. The International Tin Committee has raised quotas from 65 to 70 per cent, retroactive to July 1. Normally this information would have depressed the market here, but its effects were lost because of the influence exerted on tin by other metals such as copper and lead. At London this morning, standard metal sold at £228 for spot, and £219 5s. for futures. The Eastern quotation was £224 2s. 6d.

Zinc

Zinc prices were raised yesterday to 4.85c. a lb., East St. Louis, and 5.22½c. a lb., New York, for Prime Western grades. While current buying cannot be called active, the decision of mining interests to advance ore prices $1 a ton made it necessary for converters to ask a $2 per ton increase in order to operate profitably. Preceding the advance, bookings grew heavier, and at the end of the week about 4000 tons of fill-in business had been placed. Stocks are perceptibly diminishing, and this factor, in conjunction with restrictive measures recently applied by a number of mining interests, considerably brightens the market's statistical position.

Non-Ferrous Averages

The average prices of the major non-ferrous metals for September, based on daily quotations in THE IRON AGE, are as follows:

	Average
Electrolytic copper, N. Y.‡.	8.521c. a lb.
Lake copper, Eastern delivery	8.900c. a lb.
Straits tin, spot, N. Y.	49.069c. a lb.
Zinc, East St. Louis	4.669c. a lb.
Zinc, New York	5.044c. a lb.
Lead, St. Louis	4.263c. a lb.
Lead, New York	4.413c. a lb.

‡Price ¼c. higher in Connecticut Valley.

The Week's Prices. Cents Per Pound for Early Delivery

	Oct. 2	Oct. 3	Oct. 4	Oct. 5	Oct. 7	Oct. 8
Electrolytic copper, N. Y.*	8.75	8.75	8.75	8.75	8.75	9.00
Lake copper, N. Y.	9.12½	9.12½	9.12½	9.12½	9.12½	9.37½
Straits tin, spot, New York	49.12½	49.62½	50.25	....	51.25	51.00
Zinc, East St. Louis	4.75	4.75	4.75	4.75	4.85	4.85
Zinc, New York†	5.12½	5.12½	5.12½	5.12½	5.22½	5.22½
Lead, St. Louis	4.35	4.35	4.35	4.35	4.45	4.45
Lead, New York	4.50	4.50	4.50	4.50	4.60	4.60

*Refinery quotations; price ¼c. higher delivered in Connecticut.
†Includes emergency freight charge.

Aluminum, virgin 99 per cent plus, 19c. a lb., delivered.
Aluminum, No. 12 remelt, No. 2 standard, in carloads, 16.50c. a lb. delivered.
Nickel, electrolytic, 35c. to 36c. a lb. base refinery, in lots of 2 tons or more.
Antimony, Asiatic, 14.25c. a lb., New York.
Quicksilver, $69 to $71 per flask.
Brass ingots, commercial 85-5-5-5, 8.50c. a lb., delivered; in Middle West ¼c. a lb. is added on orders for less than 40,000 lb.

From New York Warehouse
Delivered Prices, Base per Lb.

Tin, Straits pig	51.75c. to 52.75c.
Tin, bar	53.75c. to 54.75c.
Copper, Lake	10.25c. to 11.25c.
Copper, electrolytic	10.25c. to 11.25c.
Copper, castings	10.00c. to 11.00c.
*Copper sheets, hot-rolled	16.25c.
*High brass sheets	14.62½c.
*Seamless brass tubes	16.62½c.
*Seamless copper tubes	16.75c.
*Brass rods	13.12½c.
Zinc, slabs	5.75c. to 6.75c.
Zinc, sheets (No. 9), casks, 1200 lb. and over	10.25c.
Lead, American pig	5.00c. to 6.00c.
Lead, bar	6.00c. to 7.00c.
Lead, sheets	8.25c.
Antimony, Asiatic	16.00c. to 17.00c.
Alum., virgin, 99 per cent, plus	23.30c.
Alum., No. 1 for remelting, 98 to 99 per cent	18.50c. to 20.00c.
Solder, ½ and ½	30.00c. to 31.00c.
Babbitt metal, commercial grades	25.00c. to 60.00c.

*These prices are also for delivery from Chicago and Cleveland warehouses.

From Cleveland Warehouse
Delivered Prices per Lb.

Tin, Straits pig	55.75c.
Tin, bar	57.75c.
Copper, Lake	10.00c.
Copper, electrolytic	10.00c.
Copper, castings	9.75c.
Zinc, slabs	6.25c. to 6.50c.
Lead, American pig	5.20c. to 6.50c.
Lead, bar	8.50c.
Antimony, Asiatic	16.75c.
Babbitt metal, medium grade	19.25c.
Babbitt metal, high grade	58.75c.
Solder, ½ and ½	32.25c.

Old Metals, Per Lb., New York

Buying prices are paid by dealers for miscellaneous lots from smaller accumulators, and selling prices are those charged to consumers after the metal has been prepared for their uses. (All prices are nominal.)

	Dealers' Buying Prices	Dealers' Selling Prices
Copper, hvy. crucible	6.87½c.	7.62½c.
Copper, hvy. and wire	6.75c.	7.25c.
Copper, light and bottoms	5.75c.	6.25c.
Brass, heavy	3.87½c.	4.50c.
Brass, light	3.12½c.	3.87½c.
Hvy. machine composition	6.00c.	6.50c.
No. 1 yel. brass turnings	5.12½c.	5.62½c.
No. 1 red brass or compos. turnings	5.50c.	6.00c.
Lead, heavy	3.37½c.	3.75c.
Zinc	2.37½c.	2.75c.
Cast aluminum	12.12½c.	13.25c.
Sheet aluminum	13.25c.	14.75c.

Fabricated Structural Steel

Awards Higher—New Projects in Large Volume

LETTINGS of 20,100 tons, which compare with 17,025 tons last week, include 5500 tons for transmission towers for the Metropolitan Water District, Los Angeles, 2250 tons for an incinerator in New York, and 1700 tons for the first unit of a plant for the Chevrolet Motor Co. at Indianapolis. New projects of 47,365 tons are the heaviest since the last week in June and compare with 16,200 tons in the previous week and 11,250 tons two weeks ago. Among new jobs reported are 14,700 tons for extensions of the West Side highway in New York, 7500 tons for four public schools in New York, and 5400 tons for the Manhattan approach to the Triborough bridge, New York. Plate awards are small at 500 tons, with 5200 tons pending. A bulkhead at Government Island, Cal., for the United States Coast Guard calls for 3300 tons of sheet piling. Structural steel awards for the week follow:

NORTH ATLANTIC STATES

Bridgeport, Conn., 140 tons, State highway bridge, to Fort Pitt Bridge Works Co.

Brooklyn, 1170 tons, gymnasium and heating plant for Brooklyn College, to McClintic-Marshall Corpn.

New York, 350 tons, theater building in Bronx, to Egleston Brothers & Co.

New York, 2250 tons, incinerator, to Ingalls Iron Works Co.

Syracuse, N. Y., 315 tons, mail and service building for New York Central Railroad, to Shoemaker Bridge Co.,

West Oneonta, N. Y., 120 tons, State highway bridge, to American Bridge Co.

Chautauqua County, N. Y., 100 tons, State highway bridge, to R. S. McManus Steel Construction Co.

Bound Brook, N. J., 100 tons, building for Sherwin-Williams Co., to Rogers Structural Steel Co.; H. K. Ferguson Co., Cleveland, general contractor.

Camden, N. J., 215 tons, theater, to Belmont Iron Works.

Palmerton, Pa., 950 tons, furnace building extension for New Jersey Zinc Co., to American Bridge Co.

Washington, 450 tons, extensible building bridges, to Harris Structural Steel Co.

Washington, 1170 tons, book stack columns, Library of Congress, to Fort Pitt Bridge Works Co.

THE SOUTH

Baltimore & Ohio Railroad, 2060 tons, relocating bridge near Grafton, W. Va., to McClintic-Marshall Corpn.

Brownsville, Tex., 260 tons, terminal facilities, to Alamo Iron Works.

Conroe, Tex., 265 tons, Montgomery County court house, to Mosher Steel & Machinery Co.

CENTRAL STATES

Detroit, 165 tons, bridge, to American Bridge Co.

Indianapolis, 1700 tons, first unit of Chevrolet plant, to R. C. Mahon Co.

Riverdale, Ill., 285 tons, building No. 18 for Acme Steel Co., to an unnamed bidder.

Madison, Wis., 180 tons, bridge for Milwaukee Road, to Worden-Allen Co.

Grant County, Wis., 160 tons, bridge, to A. C. Woods & Co.

Pekin, Ill., 240 tons, high school building, to Mississippi Valley Structural Steel Co.

Peoria, Ill., 320 tons, miscellaneous material, to Mississippi Valley Structural Steel Co.

WESTERN STATES

Garfield, Utah, 150 tons, building for American Smelting & Refining Co., to Kansas City Structural Steel Co.

Everett, Wash., 100 tons, digester plant, to Isaacson Iron Works.

Bonneville, Ore., 700 tons, gates, to Worden-Allen Co.

Fort Seward, Cal., 100 tons, suspension bridge, to an unnamed bidder.

Los Angeles, 5500 tons, transmission towers for Metropolitan Water District, to Pacific Coast Steel Corpn.

Venice, Cal., 150 tons, shop buildings at Venice high school, to Consolidated Steel Corpn.

Needles, Cal., 500 tons, building, to Wisconsin Bridge & Iron Co.

NEW STRUCTURAL STEEL PROJECTS

NORTH ATLANTIC STATES

Providence, R. I., 1000 tons, Mount Pleasant school.

New York, 5400 tons, Manhattan approach, contract No. 48, Tri-borough bridge; bids Oct. 17.

New York, 12,000 tons, extension West Side highway between Forty-ninth and Fifty-seventh Streets.

New York, 3500 tons, addition to Bellevue Hospital.

New York Central Railroad, 2600 tons, seven bridges.

New York, 2700 tons, extension West Side highway, Seventy-sixth to Seventy-ninth Streets.

New York, 900 tons, public school No. 107; bids Oct. 15.

Brooklyn, 800 tons, public school No. 247; bids Oct. 15.

Brooklyn, 3300 tons, Franklin K. Lane high school; bids Oct. 15.

State of New York, 1700 tons, highway bridges.

Whitney Point, N. Y., 200 tons, school building.

Springfield, Long Island, 2500 tons, high school; bids Oct. 15.

Canisteo, N. Y., 300 tons, State bridge.

Jefferson County, N. Y., 250 tons, State bridges.

Philadelphia, 350 tons, alteration to terminal building for Philadelphia & West Chester at Market and Sixty-ninth Street.

Reading, 400 tons, high school; new bids being taken Oct. 29.

New Castle, Del., 100 tons, Pennsylvania Railroad grade separation for Delaware Highway Department; J. A. Bader, Wilmington, low bidder.

THE SOUTH

State of Kentucky, 250 tons, bridges.

Newport, Ky., 200 tons, bridge.

Coal Creek Tenn., 400 tons, bridge.

Sheffield, Ala., 2000 tons, lock.

Norris Dam, Ala., 630 tons, spillway bridge for Tennessee Valley Authority.

Wheeler Dam, Ala., 1280 tons, roadway bridge for Tennessee Valley Authority.

CENTRAL STATES

State of Michigan, 300 tons, bridges.

EXTERIOR view of Berloy steel-frame house built in Washington by the Berger Mfg. Co., Canton, Ohio, Republic Steel Corpn. subsidiary. They have seven rooms, bath, detached garage and are completely air-conditioned. The entire steel frame was erected by five men in 13 hr. and the house itself completed in a month.

Lansing, Mich., 460 tons, three bridges; bids taken Oct. 3 by Michigan State Highway Department.

Cleveland, 300 tons, buildings for Easterly Sewage Disposal plant; bids Oct. 17.

Columbus, Ohio, 400 tons, tunnel.

State of Wisconsin, 260 tons, bridge.

Pisgah, Iowa, 150 tons, State highway bridge.

State of Missouri, 840 tons, highway bridges, including Clark County, 360 tons, and Pike County, 300 tons; bids Oct. 11.

Labette County, Kan., 150 tons, highway bridge; bids Oct. 15.

Wakefield, Kan., 400 tons, bridge.

Moran, Kan., 300 tons, bridge.

Chetopa, Kan., 500 tons, bridge.

WESTERN STATES

Chouteau County, Mont., 271 tons, State bridge over Marias River; bids Oct. 15.

Salt Lake County, Utah, 100 tons, State bridge; bids Oct. 14.

Salimas, Cal., 348 tons, bridge for Southern Pacific Co.; Bids under advisement.

Los Angeles, 250 tons, tunnel forms for Metropolitan Water District; Youngstown Steel Car Corpn. low bidder.

Jefferson County, Wash., 122 tons, State bridge over Big Quilence River; bids Oct. 15.

Bonneville, Ore., 550 tons, State highway bridge.

FABRICATED PLATES

AWARDS

Boulder City, Nev., 100 tons, two oil tanks, to California Steel Products Co.

Fort Peck, Mont., 400 tons, dredge pipe, to McClintic-Marshall Corpn.

Fort Peck, Mont., 805 tons, 28-in. pipe, to Treadwell Construction Co.

NEW PROJECTS

Dunkirk, N. Y., 300 tons, standpipe for city.

Pittsburgh, 400 tons, four steel scows; bids by United States Engineer Office, Oct. 12.

Coal Creek, Tenn., 1000 tons, drum gates.

Everett, Wash., 1000 tons, 24 and 36-in. pipe line extension; bids opened.

Tacoma, Wash., 1400 or 2100 tons, replacement and extension to Green River pipe line, concrete alternates on 7370 ft. of 52-in. pipe; bids Oct. 18.

Denver, 900 tons, waterworks syphon.

SHEET PILING

AWARDS

Government Island, Cal., 3300 tons, bulkhead for United States Coast Guard, to Pacific Coast Steel Corpn.

NEW PROJECTS

Philadelphia, 320 tons, for reconstruction of shipway No. 1, Philadelphia Navy Yard; bids Oct. 22.

Black River, Wis., 250 tons, lock.

San Diego, Cal., 400 tons, bulkhead for Naval District; general contract let.

Reinforcing Steel

Awards 6,750 Tons—New Projects 3,700 Tons

AWARDS

Brookline, Mass., 300 tons, underpass, to Northern Steel Co.

State of Illinois, 100 tons, paving, to Concrete Engineering Co.

State of Indiana, 100 tons, mesh for paving, to Truscon Steel Co.

Benton Harbor, Mich., 325 tons, bridge, to an unnamed bidder.

Burlington, Iowa, 1100 tons, dam No. 18, to Concrete Steel Co.

San Francisco, 1054 tons, Government mint, to Colorado Fuel & Iron Products Co.

Los Angeles, 3419 tons, material for United States Engineers, to California Hardware Co.

State of Washington, 102 tons, bridges in two counties, to unnamed bidders.

State of Oregon, 217 tons, bridges in three counties, to unnamed bidders.

NEW REINFORCING BAR PROJECTS

Hartford, Conn., 490 tons, sewerage disposal plant.

New York, 1500 tons, Manhattan approach, contract No. 48, Tri-borough bridge; bids Oct. 17.

Reading, Pa., 1150 tons, reservoir; bids Oct. 16.

Reading, Pa., 500 tons, high school; new bids being taken Oct. 28.

Lansing, Mich., 130 tons, three bridges; bids taken by Michigan State Highway Department Oct. 3.

Chicago, tonnage being estimated, four sections of intercepting sewers for Sanitary District; bids Oct. 10.

Chicago, 100 tons, addition to American Medical Association building.

Milwaukee, 1700 tons, clear wells and filters for municipal filtration plant; Kroening Engineering Corpn., 4500 West Mitchell Street, low bidder.

St. Louis, 100 tons, Watson Road bridge over River Des Peres Parkway; Stiers Brothers Construction Co., general contractor.

Lewis and Clark County, Mont., 164 tons, State underpass; bids Oct. 15.

Los Angeles, 611 tons, material for Metropolitan Water District, Schedule 45601; bids opened.

Chouteau County, Wash., 234 tons, State bridge over Marias River; bids Oct. 15.

Pearl Harbor, T. H., 1050 tons, barracks and buildings at Naval Air Base; bids Oct. 16.

Timken Steel & Tube Co., Canton, Ohio, has opened office at 16 West Sixtieth Street, New York, to better serve Metropolitan area trade in seamless tubing and alloy steel of all types. Arthur R. Adelberg has been appointed district manager of sales in charge of new office.

Tubular Service Corpn., Bush Terminal, Brooklyn, has removed Boston office and warehouse from 23-35 Purchase Street, to 69-71 Hampshire Street, Cambridge, Mass. Edward J. Weir, formerly Philadelphia manager for Tubular Service Corpn., has been appointed district manager for new Boston district office, and Joseph F. Freeman has been appointed district manager for Philadelphia district.

Swinging-Arm Spraying Machine

FOR spray coating of sheet metal and other flat products on a production basis, with the material moving on a conveyor while being sprayed, a swinging-arm spray-coating machine has been brought out by the DeVilbiss Co., Toledo, Ohio. This machine is designed to apply a smooth, even finish at a speed of from 10 to 40 lin. ft. per min., depending upon the type of surface, kind of finish, finishing material used and speed of conveyor.

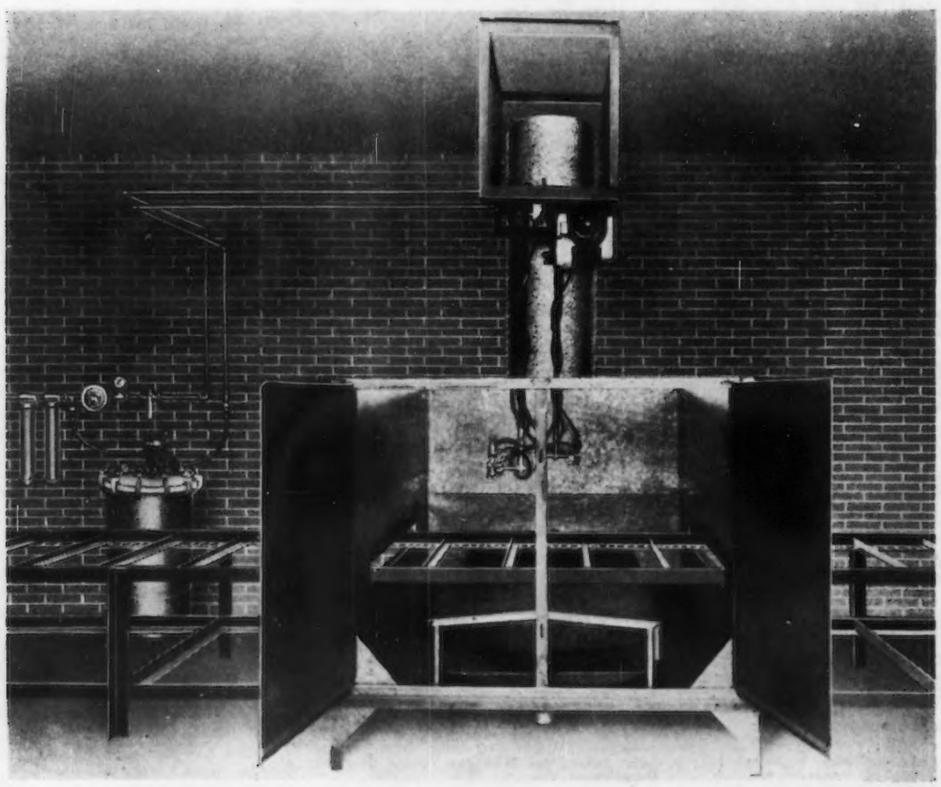
Supported on a frame, the machine is anchored to the ceiling above the conveyor carrying the work to be sprayed. It has two spraying arms, driven by a mechanism so designed that a slowly increasing and decreasing reciprocating motion is obtained, which compensates for the arc that would be produced by swinging the arms from a fixed position. This makes possible a uniform sprayed coating from one side of the work to the other. Thus the machine closely follows the technique of the manual spraying operation. The spray guns are automatically opened and closed at the beginning and end of each stroke, as is done in proper hand operation. The spraying time of the guns during the stroke can be varied to suit the width of the product to be sprayed.

A spray booth of a special design is provided for use with a conveyor in connection with the machine. This, made of galvanized steel, has four sides and a bottom. The conveyor carrying the work passes through openings on opposite sides of the booth. The front of the booth consists of two large doors permitting easy access for cleaning. The bottom is flat, usually about 12 in. from the floor of the room. The exhaust duct at the bottom of the booth is at right angles to the conveyor and has a removable top and adjustable side openings to permit an even distribution of exhaust. Fan connection is made at the back of the booth, from which the exhaust pipe may be run in a vertical or horizontal direction. Either a 1 or 2-hp. exhaust fan may be used, depending on the size of the booth.

Having an open top, air is drawn through the booth in a downward direction or the same direction in which the guns spray. There is nothing above the conveyor except the sheet metal that forms the sides of the booth so that there is no surface upon which deposits may accumulate and later drop off on the finished work. The booth size depends upon the width of the work to be sprayed. Normally it should be about 4 ft. wider than the work, about 5 ft. high and 8 ft. long.

Standard items of spraying equipment, consisting of a pressure-feed paint tank, air and fluid piping, valves, regulators, gages, etc., are used to complete the installation.

The swinging-arm spraying machine and down-shaft spray booth are to be built on special order only, as each installation has its own particular requirements and no two can be served with exactly the same equipment. The use of this spraying machine and booth is recommended only in cases where it is found after a careful survey that their use will increase production and result in lower coating costs.



This Week on the Assembly Line

(CONTINUED FROM PAGE 53)

sibly machine tools in other General Motors plants may be removed to Saginaw. Chevrolet apparently has set up a separate company, known as the Chevrolet Parts Co., to handle parts manufacture at Saginaw. Equipment purchased by Chevrolet at Flint during the summer and supposedly to be shipped to Saginaw for transmission work has been delivered to Muncie Products, where Chevrolet is making transmissions.

The two busiest factories in the industry are Buick and Packard. The former had built 12,000 of its 1936 cars up to Sept. 30 and then had on hand orders for 13,870 cars. This month it expects to make 16,000 cars, the largest number for any month since August, 1930. Over 700 cars a day are currently being produced at Flint.

Packard expects to manufacture 7000 cars in October, or 500 more units than in any previous month in its history. On Sept. 30 it built 372 cars, the largest daily output since it began making cars in 1899.

Plymouth, with a goal of 500,000 cars in 1936, is getting under way rapidly, as is Dodge, which hopes to turn out 18,000 units this month. Hupmobile, despite its legal entanglements and the washing of its dirty linen in Detroit courts the past week, is strengthening its position and will have a full line of cars the coming year.

Cadillac and La Salle Models Unveiled

Cadillac is introducing this week its 1936 models including a new series 60, powered by a V-eight motor and priced at $1,645. This car's motor is of entirely new design and has a cylinder block and crankcase cast in one piece in the Cadillac foundry. Cadillac set up a new machining line said to be one of the best in the industry to machine the block. In the closed models of the 60 series, the turret top slides and rear floor are of steel. Cadillac now has double anti-sway steel stabilizers, one at the rear of the chassis and another at the front. The 60 is capable of road speeds up to 90 and 100 miles an hour.

The La Salle line has been lowered in price to a range of $1,175 to $1,255 at the factory. Aside from a downward readjustment in prices La Salle has made only minor changes for 1936.

Gar Wood has announced that he will build motor buses designed by William B. Stout and patterned after the latter's scarab passenger car. The new buses will have the engine installed in the rear and will have streamlined bodies unitbuilt on a framework of welded alloy steel tubing. This process of manufacture will reduce the weight for a 24-passenger bus to 6000 lb. The design will permit use of various types of engines made by car manufacturers.

Pipe Lines

Metropolitan Water District, 306 West Third Street, Los Angeles, asks bids until Oct. 24 for 24,549 ft. of ⅝-in. plate steel pipe, 10 ft. 10 in. diameter, for upper feeder of Colorado River aqueduct distribution system between points near San Bernardino and Glendora, Cal.; also for 6000 lb. castings for manhole covers and saddles and 3000 lb. blow-off and air valve connections (Specification 115).

Benavides, Tex., plans steel pipe lines for natural gas distribution. Fund of $70,000 is being arranged through Federal aid for this and waterworks system. J. E. Ward, Harvey-Snider Building, Wichita Falls, Tex., is consulting engineer.

Bureau of Reclamation, Denver, closes bids Oct. 21 for steel pipe, fittings and valves for tunnel plug outlet works for Boulder Dam; also for utility cars and miscellaneous metal work at same place (Specification 729-D).

Simrall Pipe Line Co., Mount Pleasant, Mich., has authorized new welded steel pipe line from oil field district in Montcalm County, Mich., to Toledo, Ohio., about 140 miles, where connection will be made with lines of Standard Oil Co. of Ohio, for crude oil supply for local refinery. Line will have initial capacity of about 25,000 bbl. per day. Cost over $1,000,000. C. L. Maguire is president. Standard Oil Co., noted, is interested in project and will defray part of cost.

Lewistown, Mont., plans steel pipe lines for natural gas distribution system, including welded steel pipe line for main supply from Armells, Mont., gas field district. Cost about $230,000. Financing is being arranged through Federal aid.

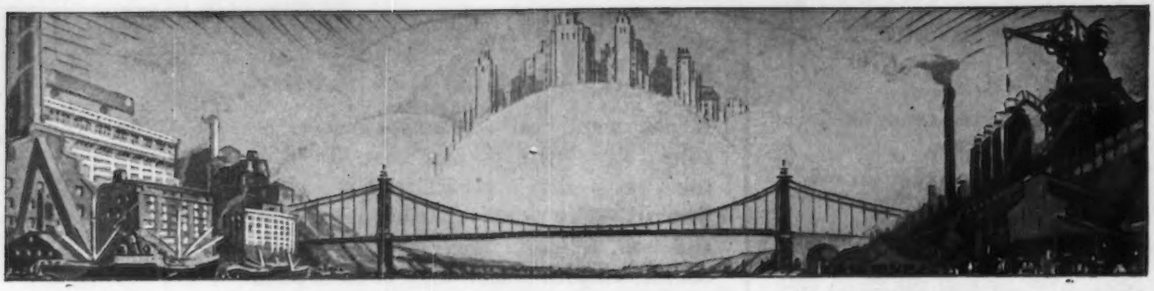
Contracting Quartermaster, Air Corps, Wright Field, Dayton, Ohio, asks bids until Oct. 18 for 900 ft. of welded steel pipe; also for 3450 ft. wrought iron pipe, pipe hangers, unions, fittings, etc. (Circular 245).

City Gas Co., Dundas Street, London, Ont., plans steel pipe lines for gas distribution, replacing a number of present lines with larger pipe and for extensions in system. Cost over $125,000. W. L. Duffield is engineer.

Portland, Ore., will take bids Oct. 17 on 536 tons of 3 to 8 in. pipe on Garden Creek distribution system; alternates on cast iron pipe.

Welding Clinics at Houston and Atlanta

TWO welding clinics—one at the Sam Houston Convention Hall, Houston, Tex., Oct. 23-26; and the other at the Georgia School of Technology, Atlanta, Ga., Oct. 30-Nov. 2—have been planned by the Linde Air Products Co., 205 East Forty-second Street, New York. Daily programs will include instruction in all types of oxy-acetylene welding and cutting and demonstrations of common applications and of latest developments in apparatus and techniques. Similar clinics held last year at Houston, Birmingham, New Orleans and Cleveland are said to have attracted an attendance of more than 10,000.



Plant Expansion and Equipment Buying

Machine Tool Business Not Yet Feeling Effect of Italo-Ethiopian War

DESPITE the fact that exports of machine tools have not been placed on the embargo list and are not likely to be, the actual outbreak of hostilities in Ethiopia has not had any visible effect on the machine tool market. One large manufacturer reports a definite recession in demand from foreign sources since the war began.

Domestic machine tool business is confined to single-tool orders and lighter units are the most active. However, much inquiry which was considered tentative prior to the Cleveland show is now definitely active. The Youngstown Pressed Steel Co., Warren, Ohio, is in the market for eight tools for its die department.

NORTH ATLANTIC

Standard Brake Shoe & Foundry Co., 30 Church Street, New York, will soon begin construction of new one-story foundry at recently acquired property, Memphis, Tenn., and will operate in conjunction with main plant at Pine Bluff, Ark. Electric furnace units and accessory equipment will be installed. Cost over $200,000 with machinery.

Seagram Distillers Corpn., 405 Lexington Avenue, New York, has acquired about 40 acres near Bernheim Lane, Louisville, and is considering new plant, to be operated as division of present distillery at Lawrenceburg, Ind., with power house, machine shop and other mechanical departments. Cost close to $1,500,000 with equipment.

Continental Can Co., 1 Pershing Square, New York, has let general contract to Austin Co., Chicago, for three-story addition to plant at 1601-57 North Kilpatrick Avenue, Chicago, 120 x 220 ft. Cost close to $1,000,000 with equipment. T. B. Jorgensen, 510 North Dearborn Street, is architect.

Department of Water Supply, Gas and Electricity, Municipal Building, New York, has taken out a permit for new electric-operated pumping plant at Neptune Avenue and West Twenty-third Street, Brooklyn. Cost about $500,000 with machinery.

American Locomotive Co., 30 Church Street, New York, has plans for one-story addition to works at Schenectady, N. Y. Cost over $50,000 with equipment.

Hartol Products Corpn., 117 Liberty Street, New York, oils, gasoline, etc., has approved plans for new bulk oil storage and distributing plant at Harrison, N. J., with steel tanks, pumping station, etc. Cost over $65,000 with equipment. Company will also enlarge bulk storage and distributing terminals at Green Island and Syracuse, N. Y., with installation of steel tanks and other facilities.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Oct. 15 for 76 ventilation fan equipments and spare parts for Brooklyn and Charleston Navy yards (Schedule 6113); until Oct. 18, snap switches (Schedule 6154); until Oct. 22, relief valves (Schedule 6121) for Brooklyn, Philadelphia and Charleston yards; 17,700 ft. bronze steam hose (Schedule 6120) for Brooklyn and Mare Island yards.

Quartermaster Supply Office, Army Base, Brooklyn, asks bids until Oct. 25 for 1614 steel snow shovels (Circular 93).

United States Engineer Office, First District, New York, asks bids until Oct. 14 for ⅝-in. iron chain and for round iron (Circular 112), steam hose and couplings (Circular 111).

Quartermaster, Fort Totten, N. Y., asks bids until Oct. 14 for one steam boiler (Circular 18).

Board of Education, 31 Green Street, Newark, plans manual training department in new three-story high school in North End district. Fund of $1,218,000 has been secured through Federal aid for building and equipment. Plans are also under way for addition to Newark Public School of Fine and Industrial Arts, High Street, for which appropriation of $360,000 has been arranged through similar financing for building and equipment.

Glemco, Inc., Newark, N. J., manufacturer of electrical specialties, has leased two floors in factory at 62 East Bigelow Street, totaling 20,000 sq. ft., floor space for new plant.

Common Council, Seaside Heights, N. J., is considering new call for bids for municipal electric light and power plant. Cost over $85,000 with equipment. Remington & Goff, 509 Cooper Street, Camden, N. J., are consulting engineers.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Oct. 15 for one motor-generator set (Schedule 6140); until Oct. 22, 725 pneumatic rivet sets (Schedule 6129) for Philadelphia Navy Yard.

Resinous Products & Chemical Co., 222 West Washington Square, Philadelphia, has let general contract to Frank V. Warren, Inc., Fifteenth and Locust Streets, for new three-story plant on Richmond Street. Cost close to $90,000 with equipment.

BUFFALO DISTRICT

Acheson Graphite Co., Buffalo Avenue, Niagara Falls, N. Y., manufacturer of lubricants, etc., has asked bids on general contract for extensions and improvements in two factory units. Cost over $45,000 with equipment.

Rochester Gas & Electric Corpn., 89 East Avenue, Rochester, N. Y., plans extensions in transmission and distributing lines in Wayne and Monroe Counties, including power substation and facilities for rural electrification in that area. Fund of $200,000 has been arranged.

R. & H. Chemicals Division, E. I. du Pont de Nemours & Co., Niagara Falls, N. Y., has let general contract to Laur & Mack, 1400 College Avenue, for one-story addition. Cost over $40,000 with equipment.

Board of Education, Lockport, N. Y., plans manual training department in new three-story high school. Cost about $850,000. Financing is being concluded through Federal aid. Bley & Lyman, 505 Delaware Avenue, Buffalo, are architects.

NEW ENGLAND

Hawie Mfg. Co., 729 North Washington Avenue, Bridgeport, Conn., manufacturer of wire and sheet metal specialties, has let general contract to John L. Simpson, 141 Putnam Street, for two-story addition, 49 x 127 ft. Cost close to $50,000 with equipment. O. N. Rasmussen, Bridgeport, is architect.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Oct. 15 for 270,000 lb. special steel tees (Schedule 6090); until Oct. 18, three tank gages (Schedule 6111) for Portsmouth, N. H., and Mare Island yards.

Raybestos-Manhattan, Inc., Railroad Avenue, Bridgeport, Conn., manufacturer of brake lining and kindred products, has acquired former Oakland paper mill of American Paper Goods Co., at Manchester, Conn., and will remodel for branch plant.

Winchester Repeating Arms Co., 275 Winchester Avenue, New Haven, Conn., has plans for addition to steam power house, and improvements in present plant.

Cost about $35,000 with equipment. A. L. Nelson, 34 St. James Avenue, is engineer.

Board of Selectmen, Lynnfield, Mass., plans manual training department in new two-story high school. Cost about $150,000. Financing is being arranged through Federal aid. Frank Irving Cooper Corpn., 47 Winter Street, Boston, is architect.

Ludlow Mfg. Associates, Ludlow, Mass., manufacturers of jute and cotton webbing, burlap products, etc., have let contract to Seymour Construction Co., 2028 Lombard Street, Philadelphia, for razing existing buildings and clearing site of 53 acres at Edge Moor, Wilmington, Del., preparatory to erection of two-story mill, 400 x 600 ft., with smaller adjoining buildings. Cost about $1,500,000 with machinery.

MICHIGAN DISTRICT

Reynolds Spring Co., Jackson, Mich., has begun construction of two-story addition, 30 x 280 ft. Cost about $45,000 with equipment.

Acme Refining Co., Alma, Mich., has asked bids on general contract for new oil refinery. Cost about $65,000 with equipment. Steel tank division will be installed for storage and distribution.

L. A. Young Spring & Wire Corpn., 9200 Russell Street, Detroit, has approved plans for one-story factory branch, storage and distributing plant at Oakland, Cal. Cost close to $30,000 with equipment.

Nylen Products Co., 13712 Tyler Street, Detroit, manufacturer gray iron castings, engine pistons, piston rings, etc., has taken over property at St. Joseph, Mich., and will soon remove plant to that location where capacity will be increased.

Murray Corpn. of America, Inc., 1424 Aberle Street, Detroit, manufacturer of steel automobile bodies, etc., has let general contract to Esslinger-Misch Co., 159 East Columbia Street, for one-story addition for storage and distribution. Cost close to $40,000 with equipment. Giffels & Vallet, Inc., Marquette Building, is architect and engineer.

WASHINGTON DIST.

Board of District Commissioners, District Building, Washington, asks bids until Oct. 15 for 1816 steel lockers.

William Schluderberg-T. J. Kurdle Co., East Baltimore Street and Eaton Avenue, Baltimore, meat packer, has asked bids on general contract for three-story addition, 80 x 95 ft. Cost over $50,000 with equipment. H. Peter Henschien, 59 East Van Buren Street, Chicago, is architect and engineer.

Purchasing and Contracting Officer, Holabird Quartermaster Depot, Baltimore, asks bids until Nov. 1 for quantity of automobile parts (Circular 50).

General Purchasing Officer, Panama Canal, Washington, asks bids until Oct. 14 for one portable air compressor, wire rope, brass dividing strips, tender brake shoes, iron mule shoes, hydraulically-operated gate valves, drill chucks, assorted files, disconnect switches, steel wire cleaning brushes, electrode holders and other equipment (Schedule 3094); until Oct. 17, one Diesel engine-operated shovel, 1½-cu. yd. dipper, caterpillar mounting (Schedule 3095).

Board of Education, Baltimore, plans manual training department in new three-story high school in Clifton Park district. Cost about $1,400,000. Joseph E. Sperry, Calvert Building, is architect; H. J. Leimbach is supervising engineer, Public Improvement Commission, City Hall, in charge.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Oct. 15 for one motor-driven bolt-threading and pointing semi-automatic machine (Schedule 6142), one motor-driven turret punch and one hand-operated turret punch (Schedule 6141); until Oct. 18, one high-speed riveting hammer (Schedule 6143), two motor-driven duplex milling machines (Schedule 6137) for Norfolk, Va., Navy Yard; until Oct. 22, copper-nickel-alloy tubing (Schedule 6059) for Eastern and Western yards.

SOUTH CENTRAL

Wright Tool Co., Bowling Green, Ky., manufacturer of oil-well drilling tools and equipment, has acquired former No. 4 plant of LaFrance-Republic Motor Truck Co., Alma, Mich., and will remodel for new branch plant.

Covington-Crenshaw-Coffee County Power Association, Covington, Ala., recently organized, plans new transmission and distribution lines, totaling about 145 miles, with power substation and facilities for electrification in rural districts of Covington, Crenshaw and Coffee counties. Project has been approved by State Rural Electrification Authority, Montgomery, Ala. Cost over $100,000.

Director of Purchases, Tennessee Valley Authority, Knoxville, Tenn., asks bids until Oct. 16 for three 100-ft. by 14-ft., riveted or welded plate steel drum gates, with accessories, for Norris power dam; until Oct. 18, lock gates, segmental valves, emergency steel dams and other equipment for Pickwock Landing lock; until Oct. 22, two low-head type cranes for Wheeler hydroelectric power plant.

Tennessee Valley Authority, Knoxville, Tenn., engineering department, plans new steel tower transmission line in western part of State, for power supply from Wilso Dam hydroelectric generating plant to Dyersburg, Covington, Trenton, Bolivar, Jackson, Somerville and neighboring communities, with rural distribution lines leading from these points, including power substation and service facilities. Surveys are being made. Cost about $1,000,000.

Board of Education, Nashville, Tenn., plans manual training department in new three-story Waverly-Belmont junior high school, for which bids will be received on general contract up to Oct. 15. Cost over $250,000. Marr & Holman, Stahlman Building, are architects.

WESTERN PA. DIST.

Pennsylvania Railroad Co., Pennsylvania Station, Philadelphia, plans installation of new revolving crane at its river-rail landing on Ohio River, near Conway, Pa.

West Virginia Steel Corpn., 1646-56 Fourth Avenue, Charleston, W. Va., F. A. Price, president, plans new local plant fronting on line of New York Central Railroad, with storage and distributing buildings and facilities, including electric-operated crane. Cost over $75,000 with equipment.

United States Engineer Office, Pittsburgh, asks bids until Oct. 25 for improvements at Emsworth Dam, including iron and steel castings, steel rails, conduits, sluice gates, etc. (Circular 75).

Weirton Steel Co., Weirton, W. Va., plans installation of new revolving crane at river dock on Ohio River at Browns Island, near Weirton, for scrap unloading.

SOUTH ATLANTIC

Stein Metal Works, 205 Decatur Street, S. E., Atlanta, Ga., manufacturer of metal products, has plans for one-story addition for storage and distribution. Cost about $25,000 with equipment.

Works Progress Committee, City Hall, Tampa, Fla., has plans for new hangar, 100 x 120 ft., at Peter Knight municipal airport, including shop and reconditioning facilities. Cost about $45,000 with equipment. M. Leo Elliott, Tampa, is architect.

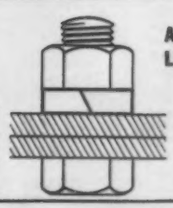
Georgetown-Standard Oil Co., Georgetown, S. C., plans new bulk oil storage and distributing plant on Sampit River, where site of about 50,000 sq. ft., has been acquired, to include pumping station, steel tanks with capacity of about 300,000 gal. and auxiliary equipment. A wharf

A.. *Live* CONTINUOUSLY WORKING PART

THE SPRING WASHER COMPENSATES FOR WEAR AND LOOSENESS

Only the *Live Action* of a Spring Washer will keep your product tight. A *live* continuously working part, with sufficient range of action to retard wear . . . and to compensate for play. This exclusive feature —*Live Action*—means longer and better service for your product...and *costs you nothing extra.*

Live Action MAKES A SPRING WASHER **LOCK!** IN SPITE OF PLAY



ALL WASHERS LOCK UNDER A TIGHT FIT

BUT ONLY A SPRING WASHER HOLDS HERE

AND EVEN HERE A SPRING WASHER **LOCKS!**

SPRING WASHER INDUSTRY

will be built for water transportation. Cost close to $45,000 with equipment.

Coca Cola Co., Atlanta, Ga., has plans for new mechanical bottling works at Pensacola, Fla., and will take bids on general contract in November. Cost over $50,000 with equipment. Francis P. Smith, Norris Building, Atlanta, is architect.

OHIO AND INDIANA

Truck Engineering Corpn., 1802 East Thirty-eighth Street, Cleveland, manufacturer of motor truck bodies, truck hoists, parts, etc., has awarded general contract to A. M. Higley Co., 2036 East Twenty-second Street, for second-story addition to one-story plant, 80 x 80 ft. Cost close to $40,000 with equipment. John W. Little, Plymouth Building, is architect.

Brass Products Mfg. Co., Cleveland, recently organized, has leased building at 10101 Quincy Avenue, S. E., for manufacture of line of brass goods. An option has been taken to purchase property.

Fisher Body Division, General Motors Corpn., 4726 Smith Road, Norwood, Cincinnati, has let general contract to J. A. Utley, 6031 Mansur Street, Detroit, for second-story addition to one of local plant units, 50 x 100 ft. Cost about $45,000 with equipment.

Automatic Reclosing Circuit Breaker Co., 1304 Indianola Avenue, Columbus, Ohio, manufacturer of electric switches and kindred equipment, will take bids at once on general contract for new one and two-story plant, 180 x 240 ft. Cost about $70,000 with machinery. T. W. Brooks, East Broad Street, is architect.

General Implement Co. of America, Inc., Guardian Building, Cleveland, manufacturer of agricultural implements, parts, etc., has acquired former factory of McKone Rubber Co., Millersburg, Ohio, and will remodel for new works.

Contracting Officer, Material Division, Air Corps, Wright Field, Dayton, Ohio, asks bids until Oct. 14 for long-nose chain pliers, 6-in. side cutting (Circular 230); until Oct. 15, hub assembly for three-blade propeller (Circular 238); until Oct. 16, liquid oxygen vaporizer assemblies, vaporizer gage and valve assemblies, container assemblies, vaporizer valve assemblies (Circular 210), 45 propeller blades (Circular 237), 7000 each instrument board lock knobs, lock spacers, lock springs and lock pins (Circular 244); until Oct. 17, eight propeller blades (Circular 212); until Oct. 18, 45 tow target rack assemblies (Circular 250); until Oct. 21, 350 gun trunnion type bolt and bracket assemblies and 150 gun mounting type post assemblies (Circular 234), rubber-metal gasoline hose with couplings (Circular 235), 125,000 ft. flexible cable (Circular 239).

Contracting Officer, Quartermaster Corps, Jeffersonville, Ind., asks bids until Oct. 23 for three motor patrol graders, three power shovels, seven graders, seven 40-hp. tactors, two 26-hp. tractors and one trailbuilder (Circular 67); until Oct. 28, 1250 33-gal. galvanized corrugated steel ash and garbarge cans (Circular 69).

SOUTHWEST

Board of Trustees, University of Missouri, Columbia, Mo., asks bids until Oct. 14 for three-story and basement addition to engineering building, with one-story wing extension for machinery department. Cost about $150,000 with equipment. Jamieson & Spearl, Arcade Building, St. Louis, are architects.

Mallinckrodt Chemical Works, 3600 North Second Street, St. Louis, has begun one-story addition to Canadian branch plant at 183 Front Street East, Toronto, for which general contract recently was let to Taylor Engineering & Construction Co., Toronto. Cost over $45,000 with equipment.

Red Star Yeast Co., Seventeenth Street and Madison Avenue, Kansas City, Mo., plans additions and improvements in present factory. Cost over $40,000 with equipment. Fred A. Rankle is company architect. Meredith Brothers, Milwaukee, Wis., are consulting engineers.

Common Council, Herndon, Kan., plans new municipal electric light and power plant and electrical distribution system. Cost about $35,000. Financing is being arranged through Federal aid. Shockley Engineering Co., Graphic Arts Building, Kansas City, Mo., is consulting engineer.

Common Council, Advance, Mo., is arranging fund of $30,000 for extensions and improvements in municipal waterworks, including new 50,000-gal. elevated steel tank on 125-ft. steel tower, pumping machinery and auxiliary equipment. Conzelman & Co., Title Guarantee Building, St. Louis, are consulting engineers.

Magnolia Airco Gas Products Co., 3500 Clark Street, Houston, Tex., has let general contract to E. C. Maclay Co., 1102 Milford Street, for one-story addition to industrial oxygen manufacturing plant, to double present capacity. Cost over $30,000 with equipment.

Houston Coca Cola Botting Co., Rusk and Rice Streets, Houston, Tex., has acquired property adjoining bottling works and plans one-story addition. Cost over $35,000 with equipment. J. E. Evans is general manager.

Common Council, Windom, Tex., asks bids until Oct. 14 for elevated steel tank and tower, pumping machinery and accessory equipment for municipal waterworks. D. C. Walmsley, Thomas Building, Dallas, Tex., is consulting engineer.

MIDDLE WEST

Phoenix Metal Cap Co., 2444 West Sixteenth Street, Chicago, manufacturer of metal specialties, has let general contract to William J. Scown Building Co., 54 West Randolph Street, for four-storage and basement addition. Cost close to $90,000 with equipment.

Signal Corps Procurement District, 1819 West Pershing Road, Chicago, asks bids until Oct. 29 for 3500 terminal blocks (Circular 19).

Central Screw Co., Thirty-fifth Street and Shields Avenue, Chicago, manufacturer of screws, studs and allied products, has let general contract to Robert Goldie Co., 19 South LaSalle Street, for one-story addition, 95 x 115 ft. Cost about $30,000 with equipment. Edward E. Peddersen, 754 Buena Avenue, is architect.

City Council, Waverly, Iowa, plans extensions and improvements in municipal electric light and power plant, including new Diesel engine units and auxiliary equipment. Cost about $110,000. Financing is being arranged through Federal aid. Howard R. Green Co., 417 First Avenue, S. E., Cedar Rapids, Iowa, are consulting engineers.

School District No. 9, La Plata County, Durango, Colo., plans manual training department in new two-story junior high school. Cost about $175,000. A bond issue is being arranged. Charles E. Thomas, Colorado Springs National Bank Building, Colorado Springs, Colo., is architect.

Mid-Continent Petroleum Co., 301 Fourth Street, S. E., Rochester, Minn., has leased property in southern part of city as site for new bulk oil storage and distributing plant. Cost about $35,000 with steel tanks, pumping equipment and other facilities.

Bureau of Reclamation, Denver, asks bids until Oct. 22 for one 10-ton electric-operated traveling crane for Government warehouse at Seminoe Dam, Casper-Alcova Project, Wyo. (Specification 730-D.)

Bendix Aviation Corpn., 105 West Adams Street, Chicago, manufacturer of aircraft and automobile equipment and accessories, has arranged for purchase of plant of Radio Products Co., Dayton, Ohio, for branch works for manufacture of airplane flying and landing instruments and kindred precision equipment. Factory will be remodeled and one-story addition built. Cost about $200,000 with equipment.

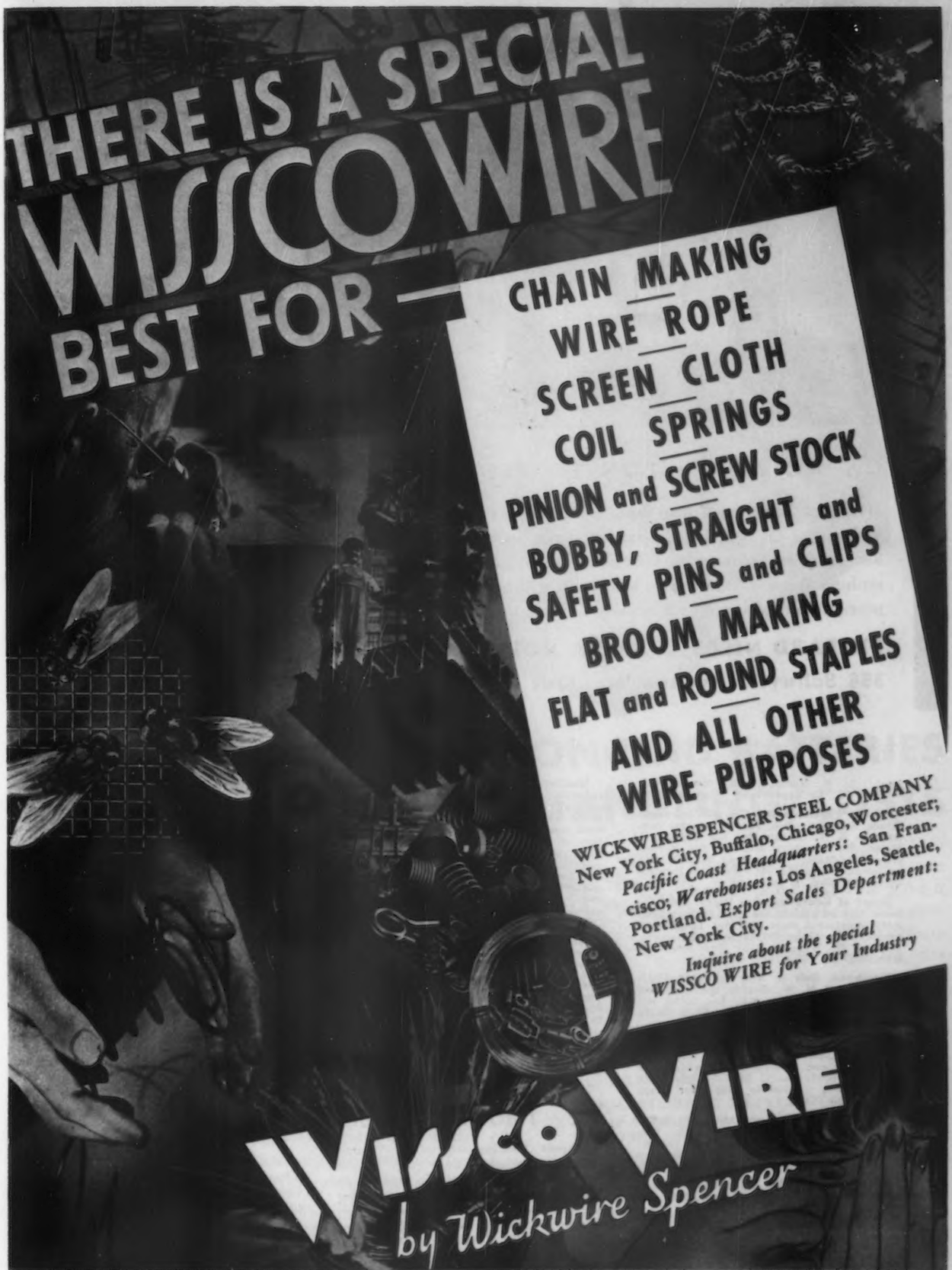
Common Council, Sheboygan, Wis., has voted bond issue of $750,000 to meet Federal grant of $592,962 for proposed municipal sewage disposal plant and system estimated to cost $1,300,000. Plans have been completed by Jerry Donohue Engineering Co., local.

Board of Vocational Education, Racine, Wis., has plans by Frank Hoffman, architect, James Block, for proposed third unit of vocational school, to cost about $200,000. Thomas S. Rees is director.

Everbrite Electric Signs, Inc., 1434 North Fourth Street, Milwaukee, manufacturer of neon and other electrical advertising units, has plans by A. L. Seidenschwartz, 2104 North Sixty-fourth Street, Wauwatosa, for factory addition, 50 x 80 ft., three stories and basement.

PACIFIC COAST

Douglas Aircraft Co., 3000 Ocean Park Boulevard, Santa Monica, Cal., manufacturer of cabin airplanes, parts, etc., is considering erection of three one-story additions. Cort over $150,000 with equip-



Wickwire Spencer manufactures High and Low Carbon Wires—in various tempers, grades and finishes—for your specific purpose. Hard-Drawn, soft or annealed Basic or Bessemer Wires—Hard-Drawn annealed, or oil-tempered Spring Wire, Chrome Vanadium Spring Wire—Valve Spring—Music—Clip—Pin—Hairpin—Hook and Eye—Broom—Stapling—Bookbinding—Machinery Spring Wire—Reed Wire—Clock—Pinion—Needle-Bar—Screw Stock—Armature Binding—Brush—Card—Florist—Mattress—Shaped—Rope—Welding. Flat Wire and Strip Steel, High or Low Carbon—Hard, annealed or tempered—Clock Spring Steel—Corrosion and Heat Resisting Wires. Consult the Wissco technical man on your wire problems, however large or small.

ment. L. B. Norman, 1034 Seventeenth Street, will be supervising engineer.

Pacific Vegetable Oil Co., 62 Townsend Street, San Francisco, has let general contract to H. T. Gettins Co., 268 Thirteenth Street, for one-story addition for storage and distribution. Cost about $25,000 with equipment. Alfred P. Fisher, Hunter-Dulin Building, is architect.

Board of Education, San Diego, Cal., has asked bids on general contract for new one-story vocational shop at Point Loma high school. Cost about $35,000 with equipment. William H. Wheeler, 2151 Guy Street, is architect.

Northwest Bolt & Nut Co., 4518 Fourteenth Street, N. W., Seattle, manufacturer of bolts, nuts, studs, etc., has taken out permit for one-sory addition, 55 x 63 ft. Cost about $25,000 with equipment.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Oct. 18 for one motor-driven engine lathe (Schedule 6094); until Oct. 22, admiralty metal tubing (Schedule 6130) for Mare Island Navy Yard.

United States Engineer Office, 751 South Figueroa Street, Los Angeles, asks bids until Oct. 23 for two 2-yd. Diesel engine-driven, crawler-type shovels, for Ballona Creek project (Circular ER-509-36-65).

Soundview Pulp Co., Everett, Wash., has begun erection of addition to pulp mill, for expansion in digester department. Cost over $75,000 with equipment.

◀ FOREIGN ▶

Chevrolet Motor Co., 3044 West Grand Boulevard, Detroit, is arranging early establishment under direction of parent organization of new assembling works at Mexico, D. F., Mexico. Cost over $100,000 with equipment.

Mauricio Hochschild, La Paz, Bolivia, capitalist, is at head of project to build a large hydroelectric generating plant at Lake Titicaca, for which concession has been granted by Government under direction of President Tejada Sorzano, who is interested in development, which is designed to furnish power for operation of State railways. Plant will have an initial capacity of 100,000 hp., and will include steel tower transmission system, power substation and switching stations and distribution lines. Cost about $25,000,000.

Mutual Pulp & Paper Mills of Prince Rupert, Ltd., Prince Rupert, B. C., recently organized, has arranged for purchase of local floating drydock and shipyards of Canadian National Railways, including adjoining land, latter to be used for erection of new pulp and paper mills. Cost close to $5,000,000 with equipment. Company will also continue operation of shipyards and will develop facilities there.

New Trade Publications

Thermit Welding. — Metal & Thermit Corpn., 120 Broadway, New York. Booklet entitled "Thermit Welding — Industry's Master Maintenance Tool," covers welding of track, repair of machine parts, huge marine castings, crankshafts, etc. Economy and permanence of repairs by this method are emphasized.

Conveyors.—Jeffery Mfg. Co., Columbus, Ohio. Catalog, 112 pages. Illustrations and lay-outs of applications covering complete line of standardized belt conveyor equipment and accessories. Tables of dimensions, loads and required hp. for diversified installations.

Speed Reducers. — Allis-Chalmers Mfg. Co., Milwaukee. Leaflet descriptive of the company's "Gearmotors" and application with any type of alternating or direct current motor.

Cable.—General Electric Co., Schenectady, N. Y. Booklet descriptive of a new paper insulated cable. A compilation of detailed information, well illustrated.

Lathes.—Greaves-Klusman Tool Co., Cincinnati. Folder. Timken equipped, geared head engine lathes. New specifications with listed improvements.

Air Heaters.—J. O. Ross Engineering Corpn., 350 Madison Avenue, New York. Bulletin describing and illustrating industrial installations of Ross systems in oven, heating, drying and air-conditioning units.

Bearings.—The Gwilliam Co., 360 Furman Street, Brooklyn, N. Y. Catalog with tables, charts, illustrations and text pertaining to use of ball and roller bearings for all purposes.

Cinder Systems. — United Conveyor Corpn., Chicago. Catalog with illustrations, diagrams and descriptions of cinder and ash disposal systems including boiler house vacuum sweeper installations.

Compressors. — Chicago Pneumatic Tool Co., 6 East 44th Street, New York. Bulletin. Two-stage air-cooled compressors in belt and motor driven types. Diagrams, illustrations and tables together with operating information and complete specifications.

Nuts.—Elastic Stop Nut Corpn., Elizabeth, N. J. Catalog, with lists, covering standard and aircraft type as well as anchor and clinch nuts. Detailed information giving symbols used in Government specifications calling for the use of the company's products.

Valves.—Yarnall-Waring Co., Chestnut Hill, Philadelphia. Folder. Diagram illustrations of forged steel blow-off valves and unit tandem valves in 600 and 1500 lb. pressure classifications. Specifications and dimension tables.

Motors.—Crocker-Wheeler Electric Mfg. Co., Ampere, N. J. Booklet of Crocker-Wheeler products including motors, generators, motor generator sets, speed changers, flexible couplings and the torquemeter. General information concerning each.

Die Heads.—Geometric Tool Co., New Haven, Conn. Booklets descriptive of styles D and DD self opening die heads and style DS die heads. Descriptions and tables covering use on various types of machines.

Hoists.—The Harrington Co., 17th and Callowhill Streets, Philadelphia. Bound bulletins with detailed information covering the hoist, track and trolley systems manufactured by the company for industrial conveying.

Pneumatic Tools. — Independent Pneumatic Tool Co., 600 West Jackson Boulevard, Chicago. Catalog. Describes and illustrates the entire line of pneumatic tools manufactured by the company under Thor trademark. Electric, contractors and mining tools are included.

Shears.—United Machine Tool Corpn., 75 West Street, New York. Catalog. Plate slitting, trimming and beveling shears. Descriptions, illustrations and specifications.

Exide-Ironclad Battery, type TLM, for powering electric industrial trucks and tractors.

FOR 25 YEARS, EXIDE-IRONCLAD BATTERIES HAVE CUT MATERIALS HANDLING COSTS

Exide IRONCLAD SILVER ANNIVERSARY 1910 – 1935

The Exide-Ironclad Battery, developed in 1910, offers many advantages to users of electric industrial trucks, the most outstanding of which is materials handling economy.

Both directly and indirectly, you can save with Exide-Ironclads. Directly, because your battery investment pays substantial returns over a long period of time—while maintenance costs are lowered from the start.

Indirect savings arise from the greater amount of work an Exide-Ironclad equipped truck can accomplish in a day. Not only does the high power ability of these batteries assure good speeds with heavy loads and grades, but their sustained voltage keeps materials moving at a productive rate clear to the end of the day.

These are the most important improvements that the Exide-Ironclad Battery, with its unique positive-plate construction, brought to materials handling service 25 years ago. They hold good today in increased degree because of the many refinements since made in the construction of the battery.

Let Exide-Ironclads improve your materials handling service at a saving. Write for free booklet, "The Adaptability of Electric Industrial Trucks and Tractors."

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

Exide
IRONCLAD
BATTERIES
WITH EXIDE MIPOR SEPARATORS

"MIPOR," Reg. U. S. Pat. Off.

American Steel Industry Is Owned By Half Million Stockholders

OF the nearly half million men and women who own the steel industry of this country, 64 per cent, many of them employees in the industry, own less than 20 shares each, while nearly 88 per cent hold less than 100 shares each. These facts were revealed by a recent inquiry conducted by the American Iron and Steel Institute among 33 steel companies representing more than 93 per cent of the steel ingot producing capacity of the country, and having 95 per cent of the total number of stockholders of the industry.

The 33 companies with 39,000,000 shares outstanding are owned by a total of 470,464 stockholders, of whom 301,002 are individual shareholders who own from 1 to 20 shares of stock apiece. A total of 111,223 stockholders own between 20 and 100 shares each, while only 58,239 or 12.4 per cent, own more than 100 shares each.

In the group owning more than 100 shares are included many blocks of shares held by insurance companies, investment trusts, stock brokers and such other large purchasers of corporate securities for the benefit of their own individual customers or stockholders.

The average holding of the owners of stock in the 33 companies amounts to only 84.4 shares, which compares with the figure of 113.9 shares per stockholder in 100 of the largest corporations in the United States, as established by a recent study.

Men outnumber women as steel stockholders, the survey disclosing that 59.5 per cent of the stockholders are men, while 40.5 per cent are women.

Approximately one out of every three employees of the steel industry shares in the ownership of the company for which he works, it is indicated by the records of 19 of the 33 companies which had information available as to the number of their employees who owned stock.

In these 19 companies, 71,944 employees were in the group of stockholders holding less than 20 shares each. They constitute one-fifth of the total number of stockholders in the 19 companies.

This group of employee-stockholders not only draw wages from the steel industry, but also have the opportunity of increasing their income by sharing in their company's profits when business conditions make profits possible.

Air Conditioning Group Setting Up Standards

A CONSTRUCTIVE program of association work is being unostentatiously carried on by the Air Conditioning Manufacturers' Association in the interest of this rapidly growing industry. Formed some 18 months ago, the association has in its membership many of the important factors in the industry. The leading engineers of the member companies, working as an engineering standards committee, have been gathering data and formulating bases for the establishment of standards for the guidance of manufacturers and users of air-conditioning equipment. The first of these standards has been practically completed for submission to the Association as the recommendation of the joint committee on rating commercial refrigerating equipment, composed of representatives of the American Society of Refrigerating Engineers, National Electrical Manufacturers Association, Refrigerating Machinery Association, American Society of Heating and Ventilating Engineers, and Air Conditioning Manufacturers' Association. This joint committee, with whom the engineering standards committee of the air conditioning group has cooperated, has recommended "Proposed Standards for the Rating and Testing of Air Conditioning Equipment," which, from the standing and experience of the sponsoring engineers should be an effective and authoritative foundation from which the air conditioning industry may progress.

The members of the association have also been active in working toward standardization of the installation and application of air conditioning and they are establishing broad and sound trade practices in an effort to avoid the abuse of public confidence from which other rapidly growing industries have suffered in the past. They feel that public recognition of air conditioning as a regular, commonplace part of daily life will rest largely on the shoulders of the responsible, reliable and progressive manufacturers who have the public interest foremost in their operations.

The present members of the Air Conditoning Manufacturers' Association are: Carrier Engineering Corpn., De La Vergne Engine Co., Frigidaire Corpn., General Electric Co., Kelvinator Corpn., J. H. McCormick & Co., John J. Nesbitt, Inc., Parks-Cramer Co., B. F. Sturtevant Co., Westinghouse Electric & Mfg. Co., and York Ice Machinery Corpn.

JUST BETWEEN US TWO

High Torque Orchid

THE Metals Exposition is a hardy perennial. It thrives in any soil. This year, planted in the heart of the stockyards district, it was in full bloom within a few hours after opening. Aisles were comfortably filled, and booths, busy.

Head Scratcher

HARDLY had we gotten our feet off the modernistic table that adorned our booth at the show, when in stalked an indignant subscriber who said that the ladder problem printed here on Sept. 26 isn't quite kosher. "How can you," he asked, "get a 20 ft. ladder and a 30 ft. ladder to cross at a point 15 ft. above an alley?"

He said he calculated it trigonometrically and that the ladders would be only a fraction of an inch apart at the base. So it is more of a fissure than an alley.

Dropped From Heaven

AFTER he left, who should drop in but the reader who sent in the ladder problem, the hog and pig feed man himself. We deposited the complaint in his lap. He scratched his head and promised he would look it up when he got home. He said he was sure his figures were right, but he looked worried.

Prodigal Son Returns

THE next caller, a manufacturer from Indiana, said he hasn't felt quite right since he let his subscription lapse about a year ago, and to send the paper again.

Too bad the Oberleutnant wasn't there that day. The Indianian's moderate praise would have pleased him. All he said was, "There's something about THE IRON AGE that gets into your blood."

Native Son Rejoins Family

A MORE articulate individual is the San Francisco manufacturer who writes:

> *"Please send me* THE IRON AGE *again. I miss it, as it gives a clear and concise record of practically all subjects that are of general interest to those engaged in the metal trades."*

Confusion

ONE of our men called the other day on a New York State firm named after two individuals, say Smith & Jones. He reports:

> *"Both Smith and Jones resigned from company. Can't tell now what is going to happen here."*

Plenty, we should say. It's like playing *Hamlet, the Prince of Denmark,* without Hamlet and without the Prince of Denmark.

A Mighty Man Was He

SPEAKING of Smiths, nineteen of them, not counting the Smyths and Smythes, registered in a single day at the Machine Tool Show.

First Run

NEWSPAPERS talk a lot about what they call "secondary" readers—you leave your paper in a train; someone else picks it up; he reads it; he leaves it in a lunchroom. . . . You get the idea.

We suspect that we now have a secondary reader, for a jeweler in Fremont, Ohio, writes in for a set of the editorials mentioned here recently. We won't brag about it, however, as it may never, we hope, happen again.

Our readers are practically all primary, between four and five per copy, and if you have not received your supply of routing forms, neatly printed with your company name and names of readers, it is because you have not asked for them. No charge. Write to 239 W. 39th St., N. Y.

Kind Words From Detroit

DESPITE the two qualifiers we won't cavil about this bouquet tossed by one of the country's No. 1 automotive moguls:

> *"I feel that* THE IRON AGE *is one of the outstanding magazines in its particular line, and I rely upon it more . . ."* —A. H. D.